DOE/NE-ID-11210

U.S. Department of Energy
Idaho Operations Office

Groundwater Monitoring and Field Sampling Plan of Operable Unit 10-08

March 2005

Idaho Completion Project

DOE/NE-ID-11210
Revision 0
Project No. 23368

Groundwater Monitoring and Field Sampling Plan for Operable Unit 10-08

March 2005

Prepared for the
U.S. Department of Energy
DOE Idaho Operations Office

ABSTRACT

This plan describes the groundwater sampling and the water level monitoring that will be conducted to evaluate contaminants in the Snake River Plain Aquifer entering and leaving the Idaho National Engineering and Environmental Laboratory. Data collected under this plan will also be used to support the Operable Unit 10-08 sitewide groundwater model. The sampling and monitoring locations were selected to meet the data quality objectives detailed in this plan. Data for the Snake River Plain Aquifer obtained under this plan will be evaluated in the Operable Unit 10-08 remedial investigation/feasibility study report.

FORWARD

This plan was developed and reviewed for approval during a contract transition period at the Idaho National Engineering and Environmental Laboratory (INEEL). During the review of this plan, the name of the INEEL was changed to the Idaho National Laboratory, and the names of some of its primary facility areas were also changed:

- Argonne National Laboratory-West became the Materials and Fuels Complex
- The Power Burst Facility became the Critical Infrastructure Test Range Complex
- The Test Reactor Area became the Reactor Technology Complex
- The Waste Experimental Reduction Facility became the Large-Scale Development Facility
- The Mixed Waste Storage Facility became the Contraband Detection Facility.

This plan does not reflect these name changes.

CONTENTS

FIGURES

TABLES

ACRONYMS

AMS	accelerator mass spectrometry
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
CoC	chain of custody
COC	contaminant of concern
COPC	contaminant of potential concern
DEQ	Department of Environmental Quality
DOE	U.S. Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
DOT	Department of Transportation
DQO	data quality objective
DR	decision rule
EPA	U.S. Environmental Protection Agency
FFA/CO	Federal Facility Agreement and Consent Order
FTL	field team leader
FY	fiscal year
HASP	health and safety plan
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
MCL	maximum contaminant level
OU	operable unit
PE	performance evaluation

PPE	personal protective equipment
PSQ	principal study question
QAPjP	quality assurance project plan
QA/QC	quality assurance/quality control
RI/FS	remedial investigation/feasibility study
ROD	record of decision
RWMC	Radioactive Waste Management Complex
SAM	Sample and Analysis Management
SAP	sampling and analysis plan
SDWS	secondary drinking water standard
SRPA	Snake River Plain Aquifer
TAN	Test Area North
TRA	Test Reactor Area
USGS	United States Geological Survey
VOC	volatile organic compound
WAG	waste area group
WGS	Waste Generator Services

Groundwater Monitoring and Field Sampling Plan for Operable Unit 10-08

1. INTRODUCTION

A number of radioactive and hazardous contaminants have been found in the Snake River Plain Aquifer (SRPA) beneath the Idaho National Engineering and Environmental Laboratory (INEEL) site. Many of these contaminants have resulted from INEEL operations conducted during the past 50 years. The SRPA has been designated a sole source aquifer by the U.S. Environmental Protection Agency (EPA), and the potential impacts to the groundwater from INEEL activities are under investigation.

Investigation and cleanup of contaminated areas at the INEEL site are done within the framework of the *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* (FFA/CO) (DOE-ID 1991) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601 et seq.). Within this framework, the INEEL site is divided into 10 "waste area groups" (WAGs), and each WAG is further divided into more manageable "operable units" (OUs).

WAG 10 at the INEEL site encompasses miscellaneous surface-contamination sites and liquid-disposal areas that are outside the boundaries of the INEEL's other nine WAGs (Figure 1-1). The OU 10-08 portion of WAG 10 addresses INEEL-related issues that are associated with the SRPA and outside the purview of the other WAGs. OU 10-08 does, however, include sites discovered within the other WAGs after their records of decision (RODs) have been signed. A numerical model is being developed for OU 10-08 to evaluate contaminant transport in the SRPA.

1.1 Project Purpose and Scope

This plan establishes the groundwater monitoring and sampling requirements for the OU 10-08 remedial investigation/feasibility study (RI/FS). OU 10-08 is responsible for determining the nature and extent of contamination in the SRPA from INEEL operations and the resulting potential risks to human health and the environment. The results of the groundwater sampling will be used to help ensure that environmental impacts associated with releases of hazardous substances at the INEEL site are thoroughly investigated and appropriate actions are taken to protect the public and the environment, as set forth in the FFA/CO (DOE-ID 1991) and CERCLA (42 USC § 9601 et seq.).

The comprehensive nature and scope of OU 10-08 necessitates that monitoring data be collected over many years and long-term integration be maintained among individual WAGs in order to ensure that the data needed for the comprehensive RI/FS are available. The large area encompassed by OU 10-08 (i.e., the entire 890-mi^2 INEEL site) and the long groundwater travel times across the area require monitoring of water quality and water levels over many years to correctly and adequately characterize the SRPA for risk-assessment calculations. In addition, it is critical that the OU 10-08 groundwater monitoring program interface with the other individual WAGs to create a synergistic and integrated understanding of the SRPA flow regime, contaminant source terms, and subsurface transport within the INEEL site boundaries. Results from the data collected under this plan will support development of the OU 10-08 groundwater conceptual model and will be used to calibrate the numerical simulation. An integrated understanding of the overall health of the SRPA beneath the INEEL site is critical for communicating INEEL impacts to other SRPA water users. Another critical purpose of OU 10-08 groundwater monitoring is to demonstrate that water contaminated above maximum contaminant levels (MCLs) or risk-based levels does not extend beyond the downgradient boundaries of the INEEL.

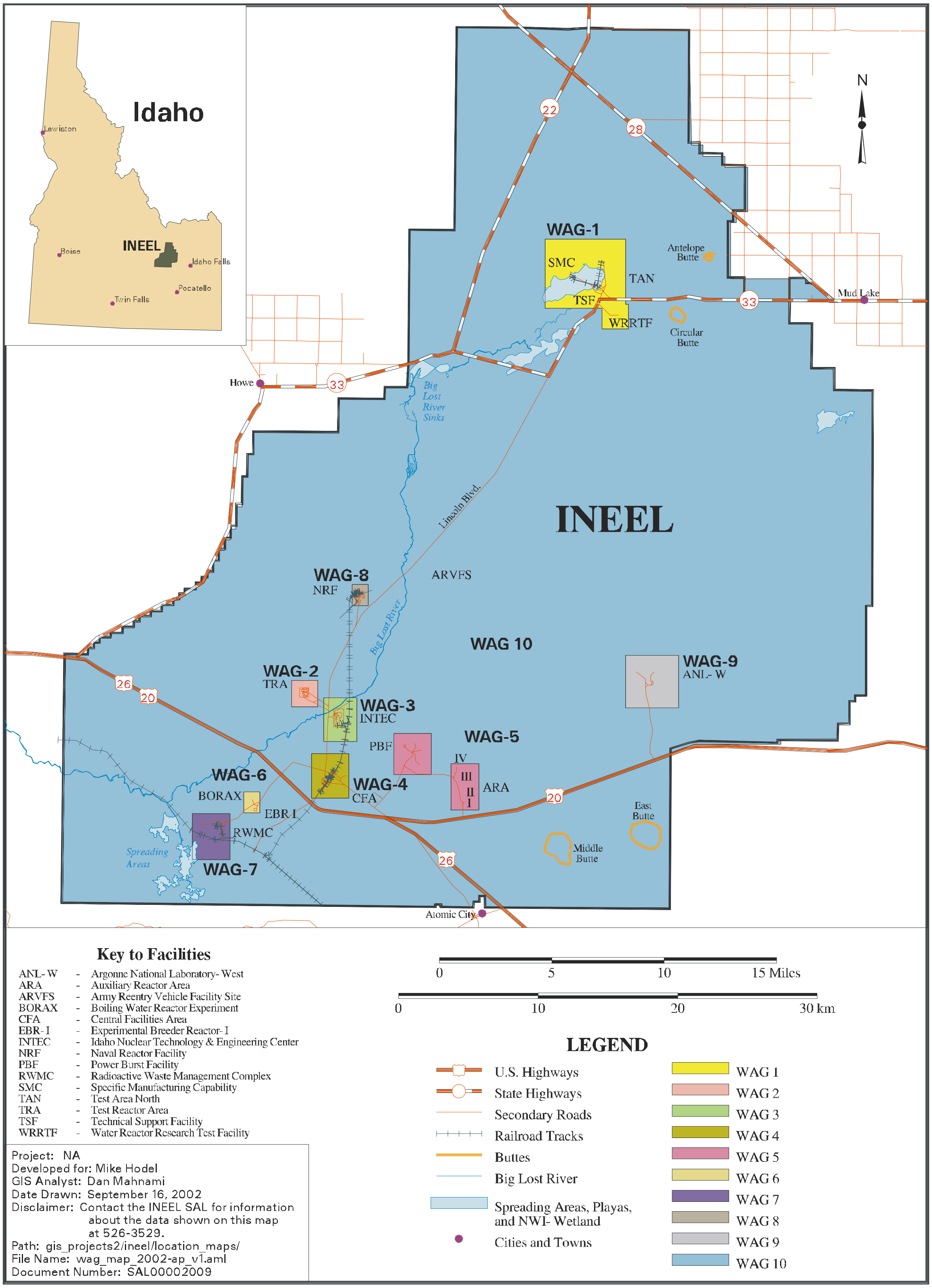

Figure 1-1. INEEL site map showing WAG locations.

Development of this plan was based on the initial three years of sampling and a review of the historical data and data gaps/needs identified in the *Waste Area Group 10, Operable Unit 10-08, Remedial Investigation/Feasibility Study Work Plan (FINAL)* (DOE-ID 2002a), which also discusses project goals. The quality assurance project plan (QAPjP) (DOE-ID 2004a) describes the processes and programs that ensure generated data will be suitable for their intended use.

The work scope of this monitoring plan is based on data gaps identified in the OU 10-08 RI/FS work plan (DOE-ID 2002a). These data gaps include the lack of consistent or accurate groundwater elevation measurements, analytical data, and new wells needed to address monitoring needs. The installation of new monitoring wells is covered in another plan (ICP 2004a). The work scope will characterize and assess INEEL-wide groundwater risks and will ultimately be used in the OU 10-08 ROD. The scope of this plan is as follows:

1. Collect data to fill data gaps in existing knowledge needed to design, develop, and calibrate the OU 10-08 groundwater model.

2. Collect data adequate to assess the risk to human health and the environment from groundwater contamination at the INEEL for the OU 10-08 RI/FS and subsequently the OU 10-08 ROD.

3. Collect data sufficient to demonstrate that groundwater contamination does not extend at significant levels beyond the downgradient boundaries of the INEEL.

Groundwater monitoring for OU 10-08, as described in this plan, is designed to (a) support the data needs for the OU 10-08 RI/FS and (b) support the transition of groundwater monitoring responsibilities into WAG 10 as the other individual WAGs are closed out under CERCLA. Water quality data are needed for the OU 10-08 RI/FS for the following purposes:

- Supporting the aquifer model calibration

- Determining whether mixing of plumes from individual WAGs can create a cumulative risk not addressed by individual WAGs

- Corroborating WAG-specific groundwater monitoring.

Note that groundwater monitoring performed under this plan will not duplicate monitoring done by other WAGs.

As the INEEL CERCLA projects move toward completion, long-term monitoring activities will be rolled up under WAG 10 and the INEEL Long-Term Stewardship program. Sitewide institutional controls and the comprehensive five-year review have already been consolidated under Long-Term Stewardship. To support CERCLA compliance monitoring at the INEEL, a comprehensive sitewide (WAG 10) groundwater monitoring plan will be prepared after the OU 10-08 ROD is signed. The comprehensive monitoring plan will encompass all groundwater sampling activities managed by the individual WAGs, and it will supersede and replace all existing groundwater monitoring plans.

1.2 Regulatory Background

On July 14, 1989, the EPA proposed placing the INEEL on the National Priorities List of the "National Oil and Hazardous Substances Pollution Contingency Plan" (40 *Code of Federal Regulations* [CFR] 300). The EPA Region 10 (with public participation during a 60-day comment period following the proposed listing) issued a final rule on November 21, 1989, that listed the INEEL on the National

Priorities List (54 Federal Register [FR] 48184). The U.S. Department of Energy (DOE) Idaho Operations Office (DOE Idaho) is the lead agency for remedy decisions. EPA Region 10 and the Idaho Department of Environmental Quality (DEQ) approve those decisions.

The FFA/CO (DOE-ID 1991) establishes the procedural framework and schedule for response actions at the INEEL in accordance with CERCLA, the Resource Conservation and Recovery Act (42 USC 6901 et seq.), and the Idaho Hazardous Waste Management Act (Idaho Code § 39-4401 et seq.). The FFA/CO signed by DOE Idaho, EPA Region 10, and the State of Idaho identifies 10 WAGs at the INEEL site (Figure 1-1).

The FFA/CO defines WAG 10 as the INEEL site boundary or beyond, as necessary, to encompass any real or potential impact from INEEL activities and any areas within the INEEL site not covered by other WAGs (DOE-ID 1991). WAG 10 encompasses a large area, and much of that area is uncontaminated. WAG 10 is also defined as the INEEL site boundary minus WAGs 1 through 5 and WAGs 7 through 9 and the Jefferson County landfill. The FFA/CO stated that the WAG 6 comprehensive RI/FS would be incorporated into the OU 10-04 RI/FS. OU 10-08 encompasses surface sites currently transferred from other OUs, new sites that may be identified after the OU 10-08 ROD is signed, and INEEL groundwater for sites with completed RODs. With concurrence from the regulatory agencies, any new site in a WAG whose ROD has been signed can also be included in OU 10-08. If an individual WAG is closed out prior to signature of the WAG 10-08 ROD, the individual WAG will continue to follow its long-term monitoring plan under the purview of Long-term Stewardship.

2. SITE DESCRIPTION AND BACKGROUND

The INEEL site is a U.S. government-owned facility managed by the DOE. The INEEL site occupies approximately 890 mi^2 of the northwestern portion of the eastern Snake River Plain in southeast Idaho (Figure 1-1), and the eastern boundary of the INEEL site is located 32 mi west of Idaho Falls, Idaho. Depth to water varies from approximately 200 ft in the northeast corner of the INEEL site to 1,000 ft in the southeast corner. Water table contours for the SRPA underneath the INEEL site are depicted in Figure 2-1. The regional groundwater flow is to the south-southwest. Locally, however, the direction of groundwater flow is affected by recharge from rivers, surface water spreading areas, pumpage, and heterogeneity in the aquifer. Across the southern INEEL site, the average gradient of the water table is approximately 5 ft/mi.

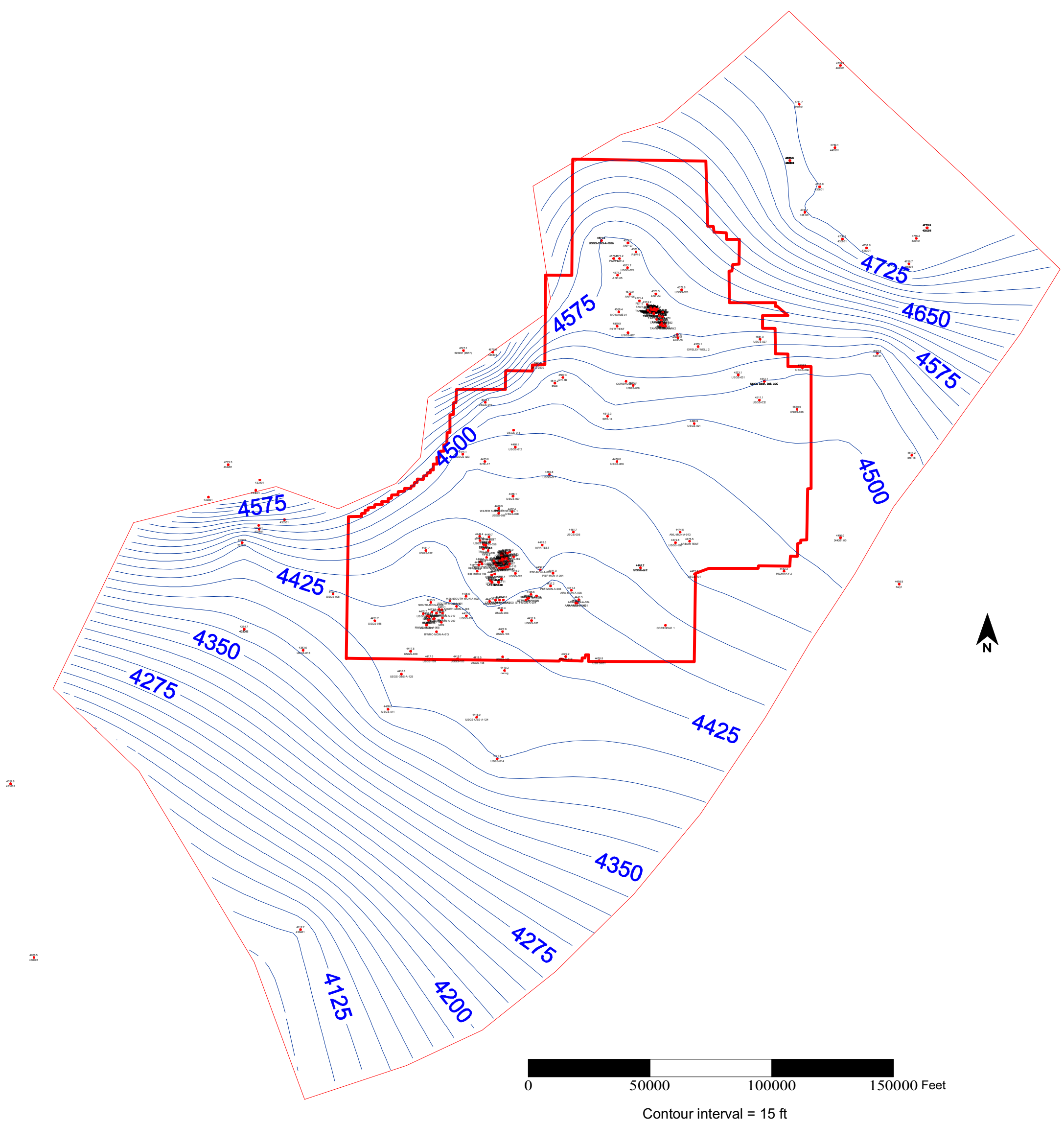

Figure 2-1. Water table elevation (in feet) map based on June 2004 data (DOE-ID 2005).

2.1 INEEL Groundwater Monitoring

Contaminant monitoring has been conducted extensively at the INEEL site since 1949 by federal and state agencies, universities, and private contractors to evaluate the distribution and transport of contaminants in groundwater. The objective of monitoring is to protect human health and the environment. The DOE has sponsored monitoring activities conducted by the United States Geological Survey (USGS), State of Idaho INEEL Oversight Program, INEEL contractors, Idaho State University, and the University of Idaho. INEEL monitoring networks now include more than 400 wells in the SRPA, vadose zone, and perched groundwater bodies. Sample results from these wells provide information on the distribution of contaminants in groundwater and define changes in contaminant concentrations in response to natural processes of dispersion, radioactive decay, and biological activity and to changes due to active remediation being performed at INEEL sites.

Contaminated groundwater at the INEEL site has been detected at the Naval Reactors Facility, the Radioactive Waste Management Complex (RWMC), the Test Reactor Area (TRA), the Central Facilities Area (CFA), the Idaho Nuclear Technology and Engineering Center (INTEC), and Test Area North (TAN) (Figure 1-1). Currently, the Idaho Completion Project and the USGS conduct monitoring to satisfy various WAG-specific program objectives. Some wells are monitored by smaller programs (e.g., Argonne National Laboratory-West). The wells are monitored as frequently as quarterly ranging to annually, depending on the data needs. A comprehensive Environmental Data Warehouse is operated by the Long-term Stewardship program to maintain records of all sampling results. Currently, Sample and Analysis Management (SAM) maintains the groundwater sampling records independently for the Idaho Completion Project and the USGS.

2.2 Previous OU 10-08 Sampling

Results of previous groundwater sampling events conducted in support of the WAG 10 RI/FS are provided in the fiscal year (FY) 2003 OU 10-08 RI/FS annual report (DOE-ID 2004b), the FY 2003 OU 10-08 RI/FS supplemental annual report (DOE-ID 2004c), and the FY 2004 OU 10-08 RI/FS annual report (DOE-ID 2005). Wells were routinely sampled for volatile organic compounds (VOCs) (Appendix IX target analyte list), metals (filtered), anions (including bicarbonate), and radionuclides (I-129, tritium, Tc-99, gross alpha, gross beta, gamma spectrometry, uranium isotopes, and Sr-90). The locations of the guard, baseline, and boundary wells are shown on Figure 2-2. The wells were selected to monitor contaminants coming onto the INEEL site (baseline), provide early warning downgradient from facilities (guard), and monitor contaminants leaving the INEEL site (boundary). The wells sampled for WAG 10 include wells that are not normally sampled under the other WAGs.

Three water quality sampling events were performed in FY 2003, and one was performed in FY 2004. Two sampling events in FY 2003—during November 2002 and June 2003—were conducted on the standard suite of guard, baseline, and boundary wells identified in the OU 10-08 RI/FS work plan (DOE-ID 2002a). In addition to wells sampled during the two standard sampling events, nine wells were sampled for explosives in March 2003 in order to satisfy the requirements of the OU 10-04 ROD associated with potential contamination in the SRPA (DOE-ID 2002b). During June and July of 2004, routine groundwater sampling was conducted for the standard suite of guard, baseline, and boundary wells. In addition to the regular suite of analytes, the Highway 3 well was sampled for nitroaromatics, and wells USGS-009, -086, -105, and -109 were sampled for C-14 in June and July of 2003.

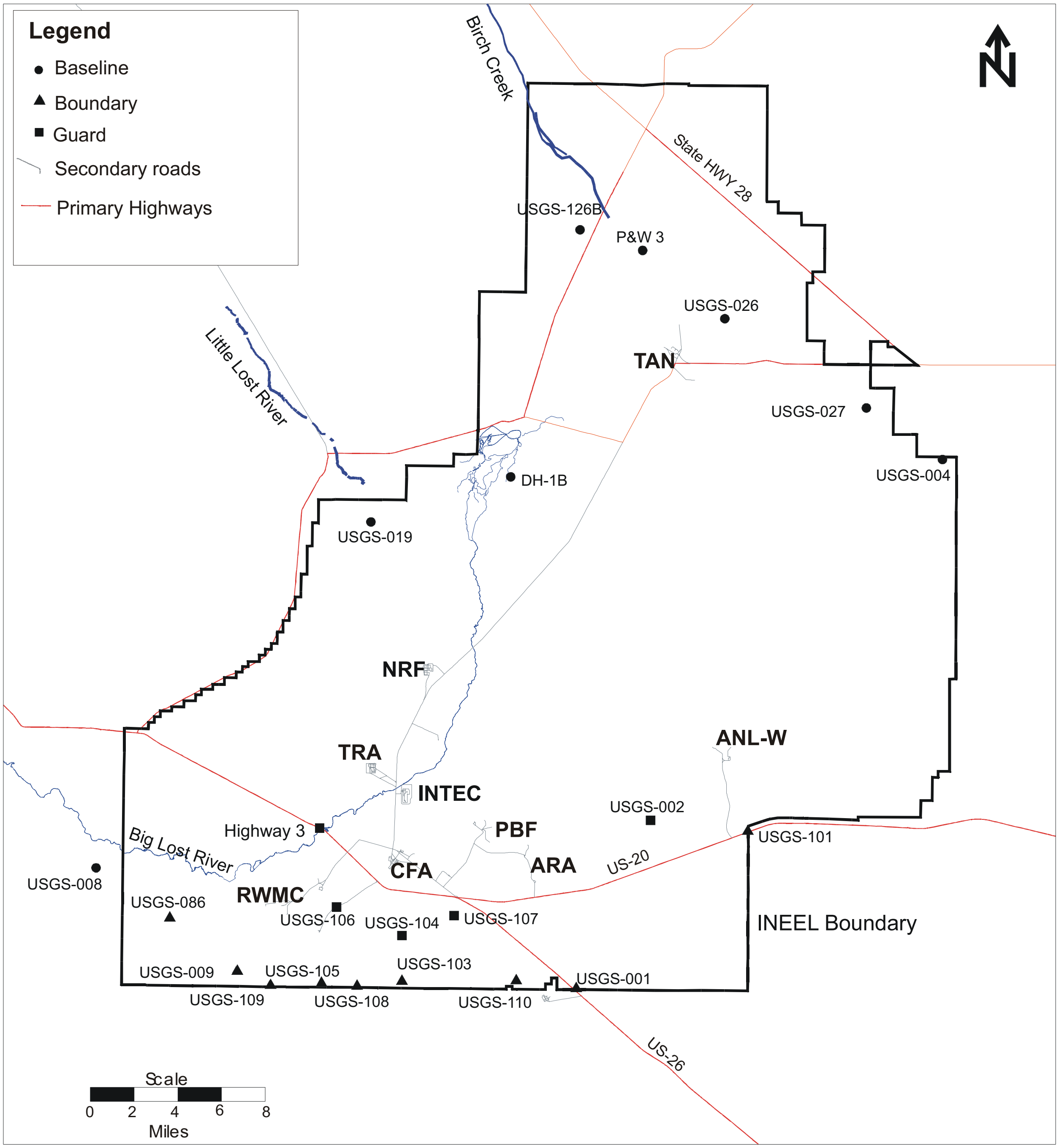

Figure 2-2. Map showing the locations of baseline, boundary, and guard wells sampled at the INEEL site in 2004.

2.2.1 Data Summary for Previous OU 10-08 Sampling Events

The concentrations of gross alpha, gross beta, and uranium isotopes in the suite of guard, baseline, and boundary wells are similar to background values (Knobel et al. 1992; USGS 1999). Tritium has been detected consistently in two wells, USGS-104 and -106, at concentrations currently near 1,000 pCi/L, which is well below the MCL of 20,000 pCi/L. Currently, both wells exhibit a downward trend in tritium concentration. Analytical results for wells sampled for C-14 were below detectable levels of approximately 2 to 4 pCi/L in the SRPA.

A few VOCs were detected at low concentrations and well below MCLs in both FY 2003 and FY 2004 sampling events. The results for the FY 2003 and FY 2004 sampling events are described in the following paragraphs.

In the FY 2003 sampling event, trichloroethene and styrene were detected in DH-1B and P&W-3 at less than 1 μg/L. Methylene chloride was also detected in DH-1B and P&W-3 at concentrations of 160 and 130 μg/L, respectively. However, methylene chloride is a common laboratory contaminant, and the data were flagged "B" because of the occurrence of methylene in the blanks. The methylene chloride data were not flagged nondetect, because they were greater than 10 times the blank. Xylenes, ethylbenzene, and chlorobenzene were detected at the Highway 3 well at less than 1 μg/L.

In the FY 2004 sampling event, bromomethane was detected in USGS-002, -109, and -106 at concentrations of 0.44, 1.1, and 1.4 μg/L, respectively. These detections are well below the MCL of 100 μg/L for trihalomethanes. Chloromethane was detected in wells USGS-109 and -106 at concentrations of 1.9 and 2.4 ug/L, respectively. Methylene chloride and sulfur dioxide were detected in DH-1B at concentrations of 26 μg/L and 1.7 μg/L, respectively. However, methylene chloride is a common laboratory contaminant and was also detected in a field blank. The methylene chloride data were not flagged nondetect, because they were greater than 10 times the blank. Trichloroethene was detected in USGS-109 at less than 1 μg/L, and carbon tetrachloride was detected in USGS-105 at 0.24 μg/L. The low concentrations of trichloroethene and carbon tetrachloride occur inconsistently and well below their 5-μg/L MCLs.

Review of the sampling results from the WAG 10 boundary, baseline, and guard wells indicates that all metals—except for thallium—and anions are below their respective MCLs or secondary MCLs. Thallium was reported at concentrations above its MCL in two wells, but when analyzed at a lower detection limit, thallium was not detected in these wells. Zinc concentrations in the groundwater samples from USGS-009, -086, -103, -104, -105, -106, -108, -109, and the Highway 3 well were elevated. The elevated zinc and concentrations in these groundwater monitoring wells are the result of corroding galvanized discharge/riser pipe used in their construction (ICP 2004b and 2004c).

The major anion and cation chemistry of baseline wells USGS-004 and -027 suggests off-site influences. USGS-004 has a much higher nitrate concentration than other wells monitored for WAG 10, and this concentration is greater than the USGS background range for the INEEL site (DOE-ID 2004c). The higher nitrate concentration in this well reflects an off-site agricultural influence. In addition, USGS-004 shows an influence of infiltration from Mud Lake based on oxygen isotope ratios that are indicative of evaporative effects (USGS 1999). The composition of USGS-027 is high in sodium and chloride compared to the other WAG 10 wells and background values for the SRPA. Wells USGS-004 and -027 also have higher conductivity values than the other wells, suggesting an off-site influence. In the vicinity of USGS-004 and -027, groundwater gradients are south to southwest based on data in the FY 2003 and FY 2004 annual WAG 10 RI/FS reports (DOE-ID 2004b and 2005). Given the location of these wells on or near the INEEL boundary, this indicates that the groundwater in these wells is influenced by off-site sources.

2.2.2 Data Summary for Explosive Sampling Events

Historical land uses at the INEEL site have included munitions and explosives testing. Potential contamination of the soil and groundwater due to the chemical compounds used in these explosives led to the March 2003 OU 10-08 sampling event and the additional sampling of the Highway 3 well in June 2004. Sampling was conducted in wells proximal to potential explosive contamination sources. The wells were sampled for trinitrotoluene (TNT), cyclotrimethylene trinitroamine (Royal Demolition Explosive [RDX]), 1,3,5-trinitrobenzene, 4-amino-2, 6-dinitrotoluene, 2,4-dinitrotoluene, and 2,6-dinitrotoluene. Analytical results for wells sampled for explosives or nitroaromatics showed that all compounds were below detectable levels in the SRPA.

2.3 Other Studies Relevant to OU 10-08

The USGS has conducted several contaminant-transport studies that have a bearing on OU 10-08 monitoring and groundwater modeling. The primary tracers used for the USGS groundwater flow and contaminant migration studies were Cl-36 and I-129; Tc-99 was used to a lesser extent. These tracers—I-129, Cl-36, and Tc-99—are present in the SRPA as a result of past facility operations and are opportunistic tracers. They were not injected as part of a tracer study. Samples collected for the I-129 and Cl-36 studies were analyzed using the low-detection limit accelerator mass spectrometry (AMS) method; samples collected for Tc-99 studies were analyzed using the thermal ionization mass-spectrometry method. The results are described below. I-129 and Cl-36 are excellent tracers for groundwater flow and contaminant migration paths. Cl-36 is an excellent tracer, because it is a conservative anion, and I-129 is an excellent tracer in anion form. In addition, I-129 and Cl-36 were selected based on their ability to distinguish sources and to be tracked over great distances.

In addition to studies within and just south of the INEEL site boundary, the USGS has conducted sampling farther south—in the Magic Valley area—to evaluate potential impacts from INEEL activities. The USGS sampling from the southern boundary of the INEEL site to the Hagerman area (Magic Valley) was conducted from 1989 to 2003. In the initial sampling in 1989, samples were collected from 55 sites. Subsequent annual sampling was done at approximately one-third of the wells, so that all of the original sites were sampled every three years.

2.3.1 USGS Studies of Contaminant Migration

A Cl-36 plume extending from TRA and INTEC to the southern INEEL site boundary is described in two studies (Beasley et al. 1993; Cecil et al. 2000). A comparison of tritium and Cl-36 data indicated that the Cl-36 plume extended beyond the area of the tritium plume defined by the 500-pCi/L concentration for tritium. Cl-36 was also detected in a well at the RWMC (Beasley et al. 1993). Based on the first detection of Cl-36 in USGS-011 and -014 (see Figure 4-1) as early as 1977, contaminant/groundwater flow velocities of approximately 3 ft/day were estimated (Cecil et al. 2000).

Sampling in 1991 and 1992 identified an I-129 plume extending from INTEC to beyond the southern INEEL site boundary (Mann and Beasley 1994). It should be noted that the I-129 concentrations south of the INEEL site boundary are low (at least two orders of magnitude below the MCL of 1 pCi/L). Groundwater flow velocity from INTEC past the southern boundary of the INEEL site was estimated at 6 ft/day based on movement of I-129 (Mann and Beasley 1994). I-129 was also detected at low concentrations in USGS-90, which is located near the RWMC (Mann and Beasley 1994). The occurrence of a low I-129 concentration near the RWMC suggests that a groundwater flow path from INTEC exists and that INTEC/RWMC plumes could be commingling. The interpretation of flow paths is complicated, because I-129 is also present in the wastes emplaced in the RWMC. Sampling of Magic Valley wells and springs south of the INEEL site from 1992 to 1994 indicated background I-129 concentrations

(Cecil et al. 2003). Although a Cl-36 plume originates from both TRA and INTEC, I-129 appears to originate from INTEC but not from TRA (Mann and Beasley 1994). In addition to samples collected during the Mann and Beasley study, I-129 samples were collected south of INTEC in 1977, 1981, 1986, and 1990.

Sampling and analysis for Tc-99 using the low-detection limit thermal ionization mass-spectrometry method indicated a plume from INTEC extending past the southern boundary of the INEEL site (Beasley et al. 1998). Tc-99 was detected in the RWMC production well, which is consistent with the low-detection limit I-129 data. This suggests that a groundwater flow path extends from INTEC to the RWMC and that commingling of INTEC and RWMC contaminant plumes is possible. The interpretation of flow paths is complicated, because Tc-99 is also present in the wastes emplaced in the RWMC. This plan proposes additional sampling to investigate that possibility.

In addition to the radiological analytes discussed above, the USGS has mapped concentrations of chlorofluorocarbons (CFCs) in the SRPA (Busenberg et al. 2001). The CFC analyses were done to estimate the age of groundwater beneath the INEEL site, but they indicated the presence of several CFC anomalies that could potentially be used as groundwater flow tracers. The CFC study indicated a plume of dichlorodifluoromethane (F-12) originating from INTEC and a 1,1,2-trichloro-1,2,2-trifluoroethane (F-113) plume originating at the RWMC. However, the CFC concentrations were very low and required special detection methods.

2.3.2 Magic Valley Sampling

The USGS has done extensive sampling south of the INEEL site boundary in the Magic Valley (Twining and Rattray 2003; Bartholomay and Twining 2000; Rattray and Campbell 2003; Bartholomay et al. 2001). When detected, concentrations of radiological analytes, such as tritium, gross alpha, and gross beta, were present at background levels and were below MCLs. Results for organics and inorganics are also reported in the documents referenced above. However, the USGS has discontinued sampling of wells south of the INEEL site boundary to the Hagerman area (Magic Valley). The Magic Valley sampling is proposed to be picked up by the State of Idaho oversight sampling program. The sampling proposed in Section 4 of this work plan is not part of the program that is to be picked up by the State of Idaho oversight sampling program.

3. FIELD SAMPLING PLAN OBJECTIVES

The data quality objective (DQO) summary in Table 3-1 is a modification of the original DQOs presented in the WAG 10 RI/FS work plan (DOE-ID 2002a). The revised DQOs for groundwater monitoring reflect the need to collect data that can be used in ascertaining the potential for plumes to commingle and in calibrating the groundwater flow model.

The EPA developed the DQO process as a means to "improve the effectiveness, efficiency, and defensibility of decisions" used in the development of data collection designs (EPA 2000). The DQO process is a systematic procedure for defining data collection criteria based on the scientific method. This process consists of seven iterative steps that yield a set of principal study questions (PSQs) and decision statements that must be answered to address a primary problem statement. The seven steps of the DQO process are as follows:

- Step 1: State the problem.
- Step 2: Identify the principal study questions.
- Step 3: Identify the inputs to the decision.
- Step 4: Define the study boundaries.
- Step 5: Develop decision rules (DRs).
- Step 6: Specify tolerable limits on the decision.
- Step 7: Optimize the design for obtaining data.

The DQOs for groundwater monitoring associated with OU 10-08 are shown in Table 3-1.

Table 3-1. OU 10-8 groundwater monitoring DQO table.

1. Problem Statement:	2. Principal Study Questions:	3. Inputs to the Decision:	4. Define the Study Boundaries:
1. What data are required to assess current conditions and future changes in the nature and extent of contamination plumes at the downgradient INEEL site boundary?	PSQ 1a. Are the downgradient nature and extent of all contaminant plumes within OU 10-08 defined? Do plumes commingle?	The following are inputs to PSQ-1a: Results from site monitoring activities performed under OU 10-08 and the other WAGs Revision of the OU 10-08 groundwater numerical model, incorporating updated site conceptual model information A geochemical study of known contaminant sources using anthropogenic contaminants and stable isotopes to help identify groundwater flow and contaminant migration pathways.	This study focuses on the transport of contaminants of potential concern (COPCs) in the groundwater from facilities within the INEEL site to its boundary and beyond. WAG 10 includes all areas within the INEEL site that are not included in the routine sampling programs for the other WAGs (principally WAGs 1, 3, 4, and 7) (Figure 1-1). However, the groundwater modeling will also make use of data collected by the individual WAGs. This plan will be in effect until the OU 10-08 ROD is signed. It is anticipated that a post-ROD long-term monitoring plan will be developed after the ROD is signed.
	PSQ 1b. Are groundwater and contaminant flow paths understood and identified?	The following are inputs to PSQ-1b: Groundwater contaminant data collected by WAG 10 and other WAGs Measurement of water levels in monitoring wells installed in the SRPA Geochemical studies to identify flow paths Geochemical or biological reactions along flow paths that can attenuate or degrade contaminant levels.	
2. Will concentrations of selected COPCs meet regulatory standards (MCLs) or other applicable risk-based concentrations at all locations within the INEEL site by 2095?	PSQ-2. Are groundwater contaminant concentrations within the INEEL site projected to comply with MCLs or other acceptable risk-based concentrations in 100 years?	The inputs to PSQ-2 may include the following: Inputs established under PSQ-1a and b, above Model prediction of COPC concentrations in the SRPA through 2095 and beyond Risk scenarios.	

5. Develop a Decision Rule:	6. Specify Tolerable Limits on Decision Errors:	7. Optimize the Design:
DR-1a. If the groundwater sampling data and the updated sitewide conceptual/numerical model indicate that concentrations of COPCs in the SRPA will be equal to or less than applicable MCLs or Regulatory Guides in 2095 and beyond, then we can conclude that additional remedial measures are not needed. DR-1b. If, after five years of monitoring and incorporation of those data into the refined OU 10-8 groundwater model, concentrations of COPCs in the SRPA are predicted to be greater than or equal to applicable MCLs or Regulatory Guides in 2095 and beyond, then additional remedial measures will be evaluated.	The primary remedial action decisions for OU 10-08 will be based on results of numerical modeling that predict groundwater concentrations in the SRPA in 2095 and beyond. As such, the decisions will be based on estimated values for which specific error limits cannot be defined in a manner similar to traditional tolerance limits applied to laboratory analytical results. The accuracy of the computer predictions will be evaluated by comparing model predictions to observed concentrations.	The WAG 10 sampling and monitoring activities will include the following: Yearly sampling of 27 wells will be used for compliance monitoring to evaluate contaminants entering and leaving the INEEL site. Annual water level monitoring of approximately 260 wells will be used to evaluate groundwater flow directions and to calibrate the sitewide groundwater model. In addition to the regular WAG 10 sampling, a one-time geochemical study of selected wells will be conducted to help refine the groundwater flow paths and contaminant sources. A post-ROD long-term monitoring plan will be developed after the ROD has been signed. The monitoring plan is expected to be revised after the OU 10-08 ROD is finalized. The geochemical study will be done to delineate groundwater flow paths in the INTEC/TRA/RWMC area and to determine off-site flow paths south of the INEEL site boundary and the extent of contamination past the southern boundary of the INEEL site. In addition, the geochemical study will attempt to resolve the source of tritium in the SRPA at and near the RWMC in order to determine whether the INTEC/TRA plumes will mix with plumes from the RWMC and to determine the source of an anion anomaly south of the RWMC. The data collected for the geochemical study are expected to refine the sitewide groundwater model that will be used for risk assessment. To achieve these objectives, selected wells will be sampled for Cl-36, I-129, sulfur and oxygen isotopes in sulfate, and nitrogen and oxygen isotopes in nitrate. Cl-36, I-129, and nitrogen and oxygen isotope ratios in nitrate will be used to evaluate flow paths from INTEC. Cl-36 and sulfur and oxygen isotope ratios in sulfate will be used to track plumes from TRA. Sulfur and oxygen isotope ratios in sulfate, along with nitrogen and oxygen isotope ratios in nitrate, will be used to evaluate the source of the anion anomaly south of the RWMC. The much lower detection limits using the AMS method for Cl-36 and I-129 will enable the Cl-36 and I-129 plumes from INTEC to be tracked over greater distances than other methods allow. The Cl-36 and I-129 data collected south of the INEEL site boundary will be used to evaluate flow paths and the potential for off-site impacts. Both I-129 and Cl-36 plumes extending south of the INEEL site boundary have been identified (Beasley et al. 1993; Cecil et al. 2000).

4. FIELD ACTIVITIES

This section describes the field activities and procedures to be used to meet the DQOs discussed in Section 3. Before beginning any sampling activities, a pre-job briefing will be held with all work-site personnel to review the requirements of this plan, the health and safety plan (HASP) (INEEL 2004), and other work control documentation and to verify that all supporting documentation has been completed. Additionally, a post-job review will be conducted at the end of the sampling and instrument installation activities. The pre- and post-job briefings will be conducted in accordance with applicable procedures. The field team leader (FTL) (and other project personnel) will need to ensure that the fieldwork is being performed using the most current and applicable procedures.

4.1 Routine Sampling Locations and Laboratory Analytes

In accordance with the OU 10-08 RI/FS work plan (DOE-ID 2002a), general well categories are listed in order of sampling priority to meet project objectives. Downgradient boundary and guard wells are considered the most important for determining compliance with MCLs and reaching cumulative risk thresholds in the groundwater from INEEL sources by FY 2095. This sampling plan is for the RI/FS, but after the OU 10-08 ROD is signed, a comprehensive long-term monitoring plan will be developed. Table 4-1 lists well identifiers, well names, and other information about the wells to be sampled. Figure 4-1 shows the locations of the monitoring wells to be sampled.

4.1.1 Analytes for OU 10-08 RI/FS

The list of analytes for OU 10-08 monitoring is based on identified contaminants of concern (COCs) in the RODs for individual WAGs (Table 4-2). The COCs are discussed in greater detail in the OU 10-08 RI/FS work plan (DOE-ID 2002a). The WAG 10 routine monitoring includes all of the analytes in Table 4-2 except for plutonium and Am-241. Both plutonium and Am-241 are monitored near INTEC and the RWMC by WAGs 3 and 7, respectively. Because of the low mobility for plutonium and Am-241, they were not included in the routine OU 10-08 monitoring.

The routine OU 10-08 sampling will include annual sampling of baseline, guard, and boundary wells (Figure 4-1). Distal wells will be sampled every two years (Figure 4-1). Distal wells are wells that are sampled to provide data to demonstrate that groundwater downgradient of the INEEL boundaries is not contaminated above MCLs or risk-based levels and to provide data for the groundwater model.

Samples will be analyzed for VOCs (Appendix IX list), metals (filtered), anions (includes chloride, sulfate, bromide, and fluoride), nitrate/nitrite as nitrogen, alkalinity (total as $CaCO_3$), tritium, I-129, gross alpha, gross beta, Tc-99, gamma spectrometry, uranium isotopes (U-233/234, U-235, and U-238), and Sr-90 (Table 4-3). Detection limits for select analytes and regulatory levels are also shown in Table 4-3. Wells USGS-009, -105, -106, -108, and -109 will also be sampled for C-14 in addition to the analytes mentioned above.

Every other year starting in 2005, the I-129 analysis for the boundary and distal wells will use the low-detection limit AMS method used by the Purdue Rare Isotope Measurement Laboratory at Purdue University. Because that laboratory is a research rather than commercial laboratory, it will not produce the data package that typically accompanies other data and does not guarantee turnaround times. Consequently, the data will not be able to be validated and might not be received in a timely manner.

Table 4-1. Specific well information.

Well Identifier[a]	Well Name	Screened or Open Hole (ft)	Pump Depth (ft)[b]	Approximate Depth to Water (ft)
		Boundary Wells		
450	USGS-001	600 to 630 perforated	612	588
458	USGS-009	620 to 650 perforated	635	607
535	USGS-086	48 to 691 open hole	678	649
550	USGS-101	750 to 865 perforated	790	771
552	USGS-103	575 to 760 open hole	700	583
554	USGS-105	400 to 800 open hole	700	670
557	USGS-108	400 to 760 open hole	637	609
558	USGS-109	600 to 800 open hole	656	621
559	USGS-110	580 to 780 open hole	612	566
		Guard Wells		
184	Highway 3	680 to 750 perforated	567	538
451	USGS-002	675 to 696 perforated	683	659
549	USGS-100	662 to 750 open hole	703	686
553	USGS-104	550 to 700 open hole	592	555
555	USGS-106	605 to 760 open hole	609	584
556	USGS-107	270 to 690 open hole	531	477
		Baseline Wells		
453	USGS-004	285 to 315 perforated 322 to 553 open hole	303	251
457	USGS-008	782 to 812 perforated	801	766
468	USGS-019	639 to 705 perforated	322	276
475	USGS-026	232 to 266.5 perforated	255	212
476	USGS-027	250 to 260 perforated 298 to 308 perforated	262	228
1346	USGS-126B	400 to 452 open hole	420	408
147	DH-1B	380 to 400 open hole	No pump	268
250	P&W-3	322 to 401 perforated	No pump	304
		Distal Wells		
460	USGS-011	672.5 to 703.8 perforated	687	658 [c]
463	USGS-014	720 to 746 perforated	739	720 [c]
987	USGS-124	750 to 800 slotted	Not found	—[c]
988	USGS-125	620 to 774 slotted	700	634 [c]

a. The well identifier is from the Hydrologic Data Repository.
b. The pump depth is the depth to the top of the pump.
c. Measurement was taken in October 2004. Well USGS-124 was not measured, because it was in use.

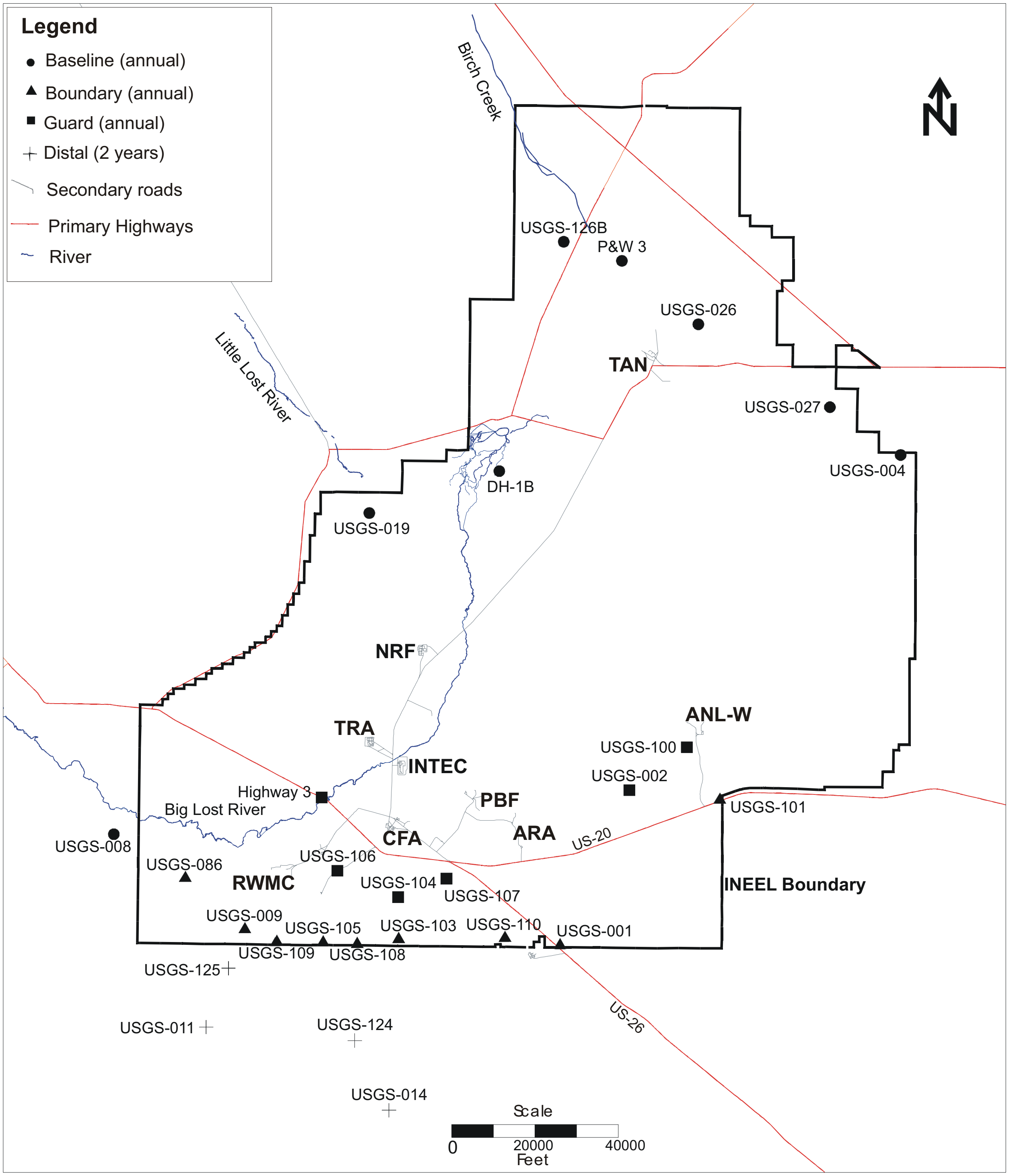

Figure 4-1. Locations of and sampling frequency for wells to be sampled for OU 10-08 RI/FS.

Table 4-2. Groundwater COCs identified in existing RODs at the INEEL site.

Contaminant Type	ROD-specified COC	Facility
VOCs:	Carbon tetrachloride	RWMC[a]
	cis-1,2-Dichloroethene	TAN[b]
	Methylene chloride (dichloromethane)	RWMC
	Tetrachloroethene	RWMC
	trans-1,2-Dichloroethene	TAN
	Trichloroethene	TAN
Inorganics:		
Metals:	Arsenic (As)	TRA[c], INTEC[d], ANL-W[e]
	Beryllium (Be)	TRA, CFA[f]
	Cadmium (Cd)	TRA, CFA
	Chromium (Cr)	TRA, INTEC, ANL-W
	Lead (Pb)	TRA
	Manganese (Mn)	TRA
	Mercury (Hg)	TRA, INTEC
	Zinc (Zn)	CFA
Other:	Fluoride (F)	TRA
	Nitrate (as nitrogen)	CFA, RWMC
Radionuclides:	Gross alpha	Part of TAN, TRA, INTEC
	Gross beta	Part of TAN, TRA, INTEC
	Gamma spectrometry	Part of TAN, TRA, INTEC, RWMC
	Uranium (U) (U-233/234, -235, -238)	TAN, INTEC, RWMC
	Iodine-129 (I-129)	INTEC, RWMC
	Plutonium (Pu) (Pu-238, -239/240)	INTEC
	Americium-241 (Am-241)	INTEC
	Strontium-90 (Sr-90)	TAN, TRA, INTEC
	Technetium-99 (Tc-99)	INTEC, RWMC
	Tritium (H-3)	TAN, TRA, INTEC, RWMC
	Chloride-36 (Cl-36)	RWMC
	Carbon-14 (C-14)	RWMC

a. The COCs for groundwater at the RWMC are from DOE-ID (2004d).
b. The COCs for groundwater at TAN are from DOE-ID (1992a, 1995a, 1999a).
c. The COCs for groundwater at TRA are from DOE-ID (1992b, 1997).
d. The COCs for groundwater at INTEC are from DOE-ID (1999b).
e. Argonne National Laboratory-West.
f. The COCs for groundwater at CFA are from DOE-ID (1995b, 2000).

Table 4-3. OU 10-08 analytes and required quantitation levels.

Contaminant Type	Contaminant Name	Action Level or MCLs	Practical Quantitation Limit or Level Required (at least half MCL)
VOCs (Appendix IX list)	Carbon tetrachloride	0.005 mg/L	0.001 mg/L[a]
	cis-1,2-Dichloroethene	0.07 mg/L	0.001 mg/L[a]
	Methylene chloride	0.005 mg/L	0.001 mg/L[a]
	Tetrachloroethene	0.005 mg/L	0.001 mg/L[a]
	trans-1,2-Dichloroethene	0.1 mg/L	0.001 mg/L[a]
	Trichloroethene	0.005 mg/L	0.001 mg/L[a]
Inorganics (Contract Laboratory Program metals plus silicon, uranium, and strontium)	Arsenic	0.05 mg/L	0.005 mg/L
	Beryllium	0.004 mg/L	0.001 mg/L
	Cadmium	0.005 mg/L	0.001mg/L
	Chromium	0.1 mg/L (total)	0.002 mg/L
	Lead	0.015 mg/L	0.002 mg/L
	Mercury	0.002 mg/L	0.0001 mg/L
	Zinc	5 mg/L (secondary drinking water standard [SDWS] [5])	0.020 mg/L
Anions	Nitrate (as nitrogen)	10 mg/L	0.5 mg/L
	Chloride	250 mg/L (SDWS [5])	0.5 mg/L
	Alkalinity (total)	Not applicable	10 mg/L
	Fluoride	4.0 mg/L (2.0 mg/L SDWS [5])	0.5 mg/L
	Sulfate	250 mg/L (SDWS [5])	1 mg/L

Table 4-3. (continued).

Contaminant Type	Contaminant Name	Action Level or MCLs	Practical Quantitation Limit or Level Required (at least half MCL)
Radionuclides[b]	Gross alpha	15 pCi/L (total)	2 pCi/L
	Gross beta (manmade)	Not to exceed 4 mrem/year to the whole body or any organ	4 pCi/L
	Gamma spectrometry (Cs-137)	200 pCi/L (total)	10 pCi/L[c]
	Uranium isotopes[d]	0.030 mg/L (total)	0.5 pCi/L
	I-129	1 pCi/L	0.2 pCi/L
	Sr-90	8 pCi/L	0.5 pCi/L
	Tc-99	900 pCi/L	10 pCi/L
	H-3	20,000 pCi/L	400 pCi/L

a. Based on 25-mL sample volume.
b. In addition, Wells USGS-009, -105, -106, -108, and -109 will be analyzed for C-14 as requested by WAG 7.
c. Based on Cs-137 with other gamma-emitting isotopes having detection limits commensurate with their photon yield and energy as related to that for Cs-137.
d. Uranium isotopes include U-233/234, U-235, and U-238.

4.1.2 OU 10-08 Sampling Schedule

The OU 10-08 routine groundwater monitoring in support of the RI/FS is scheduled for June and July of each year until the OU 10-08 ROD is signed. Figure 4-1 shows the wells that will be sampled routinely; well construction details are provided in Table 4-1. Note that the geochemical study discussed below is a one-time sampling event.

4.2 Geochemical Study

The geochemical study will attempt to resolve the source of the tritium in the aquifer at the RWMC (DOE-ID 2004e), identify flow paths of contaminants from INTEC and TRA, determine the source of the anion anomaly south of the RWMC, and identify flow paths and evaluate contaminant influence south of the southern INEEL site boundary (Figure 4-2). Identification of groundwater flow paths is essential for development and calibration of the OU 10-08 (i.e., sitewide) groundwater model. In addition, data from the geochemical study will be used to evaluate the potential for commingled plumes, which might elevate the cumulative risk above levels calculated for each plume individually.

The geochemical study will use four tracers that are currently in the SRPA as a result of INEEL operations: Cl-36, I-129, sulfur and oxygen isotope ratios in sulfate, and nitrogen and oxygen isotope ratios in nitrate. These four were selected based on their ability to distinguish sources and to be tracked over great distances. Cl-36, I-129, and nitrogen and oxygen isotope ratios in nitrate will be used to evaluate flow paths from INTEC. Cl-36 and sulfur and oxygen isotope ratios in sulfate will be used to track plumes from TRA. Sulfur and oxygen isotope ratios in sulfate, along with nitrogen and oxygen isotope ratios in nitrate, will be used to evaluate the source of the anion anomaly south of the RWMC. The much lower detection limits using the AMS method for Cl-36 and I-129 will enable the Cl-36 and I-129 plumes to be tracked over greater distances than other methods allow.

In addition to the four tracers mentioned above, carbon tetrachloride, F-113, and F-12 will be sampled for in four wells along the southern boundary of the INEEL site. The samples will be analyzed using a low-detection limit method in order to evaluate groundwater flow paths and migration from the RWMC. By using the low-detection limit method, it might be possible to detect carbon tetrachloride in some of the wells south of the RWMC. The USGS has tracked a low-concentration F-113 plume from the RWMC past the southern boundary of the INEEL site (Busenberg et al. 2001). The detection of carbon tetrachloride in any of the four wells would further substantiate the migration path indicated by the F-113 data.

4.2.1 Cl-36 and I-129

The goal of the Cl-36 and I-129 sampling is to define groundwater flow paths from INTEC and TRA, determine the potential for upgradient influences at the RWMC, evaluate the potential for commingling plumes, and evaluate the extent of contaminant migration beyond the INEEL site boundary. Existing data are insufficient to clearly identify whether groundwater contaminants beneath the RWMC are from the RWMC or from TRA and INTEC. As discussed in Section 2, data collected by the USGS also indicate a possible flow path from upgradient sources onto the RWMC (Mann and Beasley 1994; Beasley et al. 1998; and Busenberg et al. 2001). The RWMC might be downgradient from TRA and INTEC based on water level contours. A Cl-36 plume extending south of the INEEL site boundary has been identified (Beasley et al. 1993; Cecil et al. 2000). An extensive I-129 plume extends from INTEC to south of the INEEL site, but an I-129 plume was not identified at TRA (Mann and Beasley 1994).

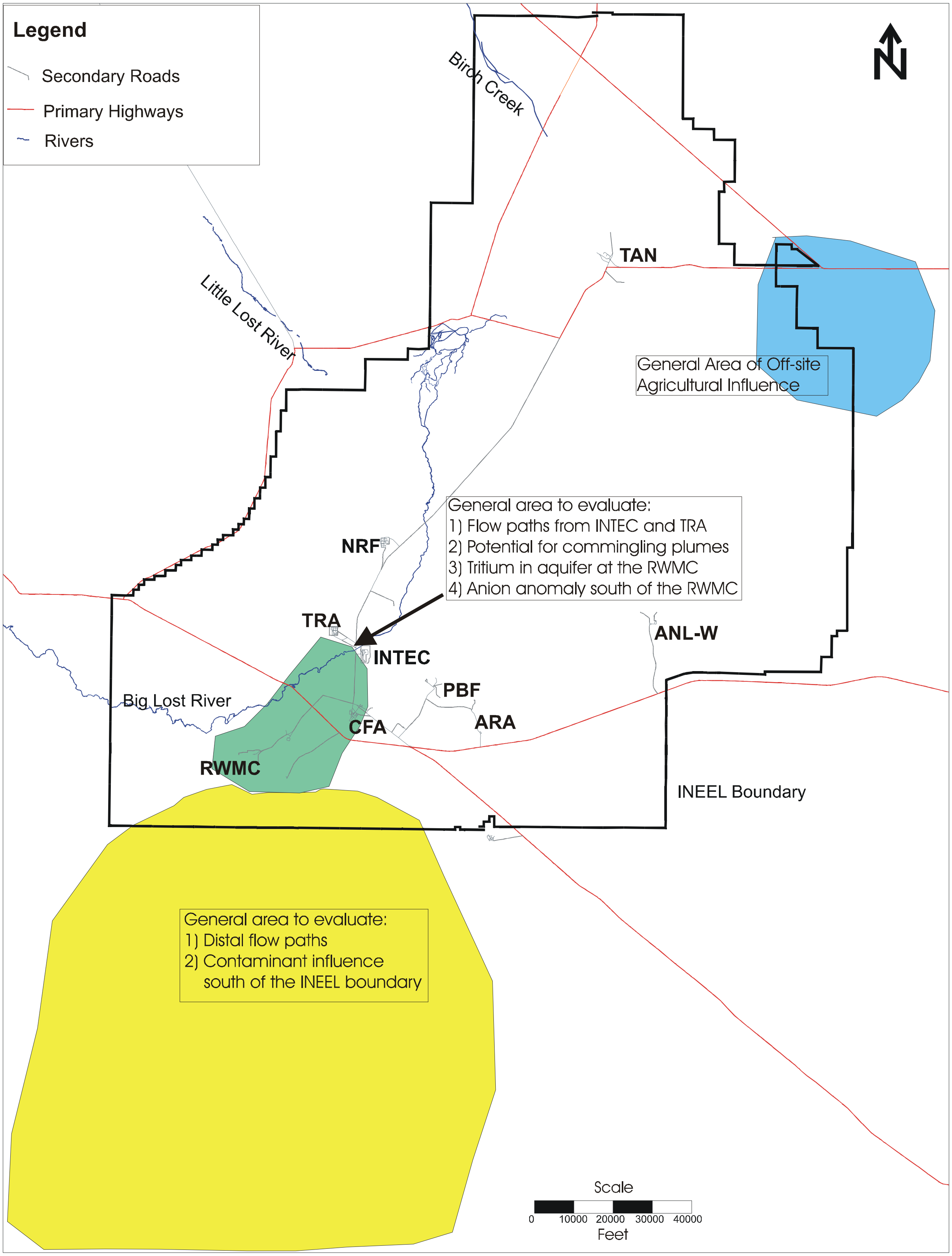

Figure 4-2. Geochemical study areas.

INTEC and TRA contaminant plumes have different chemical signatures. INTEC has both a Cl-36 and an I-129 plume, but TRA only has a Cl-36 plume (Beasley et al. 1993: Mann and Beasley 1994). The difference in I-129 concentrations between INTEC and TRA can be used along with the low-detection limit AMS method to delineate groundwater flow paths and evaluate the potential for the RWMC and INTEC/TRA plumes to mix. The Cl-36 and I-129 data collected for wells south of the INEEL site boundary will be used to track and predict the movement of contaminants in the SRPA offsite.

The wells to be sampled for Cl-36 are listed in Table 4-4 and shown on Figure 4-3. The wells to be sampled for I-129 were selected to supplement the extensive USGS sampling conducted in October 2003 for I-129 and are listed in Table 4-4 and shown on Figure 4-4. In October 2003, the USGS sampled the following wells: USGS-009, -011, -014, -020, -035, -036, -037, -038, -039, -042, -044, -047, -050, -051, -057, -077, -082, -085, -103, -104, -105, -106, -108, -109, -111, -112, -113, -114, -115, -116, -121, -123, -124, -125, -127, -128, and CFA-LF-2-10. The Fingers Butte Well, Crossroads Well, Grazing Service CCC #3, Grazing Service #2, Houghland Well, USGS-011, USGS-014, USGS-124, and USGS-125 will be sampled for I-129 and Cl-36 to evaluate the extent of contamination and contaminant flow paths south of the INEEL site boundary. The following wells will be sampled to evaluate the source of contamination at the RWMC: M1S, M6S, M11S, M12S, M13S, M14S, A11A31, and the RWMC production well. Wells USGS-009, -105 -106, -108, and -109 will be sampled for Cl-36. Wells USGS-106 and -108 will be used to evaluate Cl-36 concentrations over time, because these wells have been sampled previously for Cl-36. The ability to sample off-site wells—including the Fingers Butte Well, Crossroads Well, Grazing Service CCC #3, Grazing Service #2, and Houghland Well—will depend on access and well status in May and June 2005. In addition, the Fingers Butte Well, Crossroads Well, Grazing Service CCC #3, Grazing Service #2, and Houghland Well are not owned or maintained by the INEEL.

4.2.2 Sulfur and Oxygen Isotope Ratio in Sulfate

The purpose of the collecting the sulfur and oxygen isotope ratio in sulfate data is to evaluate groundwater flow in the INTEC/TRA/RWMC area and to determine the source of the elevated sulfate concentrations in the anion anomaly (both chloride and sulfate are elevated) on the south side of the RWMC. The wells to be sampled in this study are listed in Table 4-4 and shown on Figure 4-5. The sulfur isotope ratio will provide information on the source of the sulfur, and the oxygen isotope ratio in the sulfate will provide information on the source of the water. A couple of the possible sources for the anion anomaly south of the RWMC are leachate from the wastes within the RWMC or the magnesium chloride brine applied to the roads at the RWMC. The USGS conducted a regional $\delta^{34}S$ study, but it did not include the $\delta^{18}O$ ratios in sulfate and did not include many wells in the RWMC area (USGS 1999). If reducing conditions exist beneath the RWMC, then significant sulfur isotope fractionation could occur and the sulfate leaching from the RWMC should have a distinct ratio compared to other sources. Confirmation that leachate from wastes buried at the RWMC is the source of the sulfate would indicate that the most soluble contaminants have reached—and other contaminants might soon reach—the SRPA. The magnesium chloride brine dust suppressant used between 1984 and 1993 has migrated to a depth of at least 240 ft below the RWMC (Hull and Bishop 2003). The magnesium chloride brine might now be the source of the anion anomaly in the SRPA.

Wells M12S and USGS-106 will be sampled to evaluate the downgradient signature from INTEC, and the USGS-065, Middle-1823, and Rifle Range wells will be used to evaluate the downgradient signature from TRA. The M7S, M11S, M13S, M4D, M14S, and RWMC production wells will be sampled to evaluate the potential impacts from the RWMC or TRA/INTEC. Wells M6S, M15S, and A11A31 within the sulfate anomaly will be sampled to evaluate the source of the sulfate and possibly provide insight to the origin of the associated chloride.

Table 4-4. Wells to be sampled and analytes for the geochemical study.[a]

Location	I-129	Cl-36	Sulfur and Oxygen Isotopes	Nitrogen and Oxygen Isotopes	Metals and Anions[b]
Aquifer Wells:					
A11A31	X	X	X		Y
Crossroads Well	X	X			X
Fingers Butte Well	X	X			X
Grazing Service CCC #3	X	X			X
Grazing Well #2	X	X			X
Houghland Well	X	X			X
M1S	X	X	X		Y
M11S	X	X	X	X	Y
M12S	X	X	X	X	Y
M13S	X	X	X		Y
M14S	X	X	X	X	Y
M15S			X	X	X
M4D			X		Y
M6S	X	X	X	X	Y
M7S			X	X	Y
Middle-1823			X		X
Rifle Range			X	X	X
RWMC Production	X	X	X	X	X
USGS-009	Y	X			Y
USGS-011	Y	X			X
USGS-014	Y	X			X
USGS-065			X		Y
USGS-105	Y	X			X
USGS-106	X	X	X	X	Y
USGS-108	Y	X			Y
USGS-109	Y	X			Y
USGS-124	Y	X			X
USGS-125	Y	X			X
Perched Wells/Lysimeters:					
D06 DL01			X		Y
D06 DL02			X		Y
8802D			X		Y

a. An "X" indicates data collected during the geochemical study; a "Y" indicates data from another source will be used (for example, WAG 7 or USGS).
b. Anions include alkalinity.

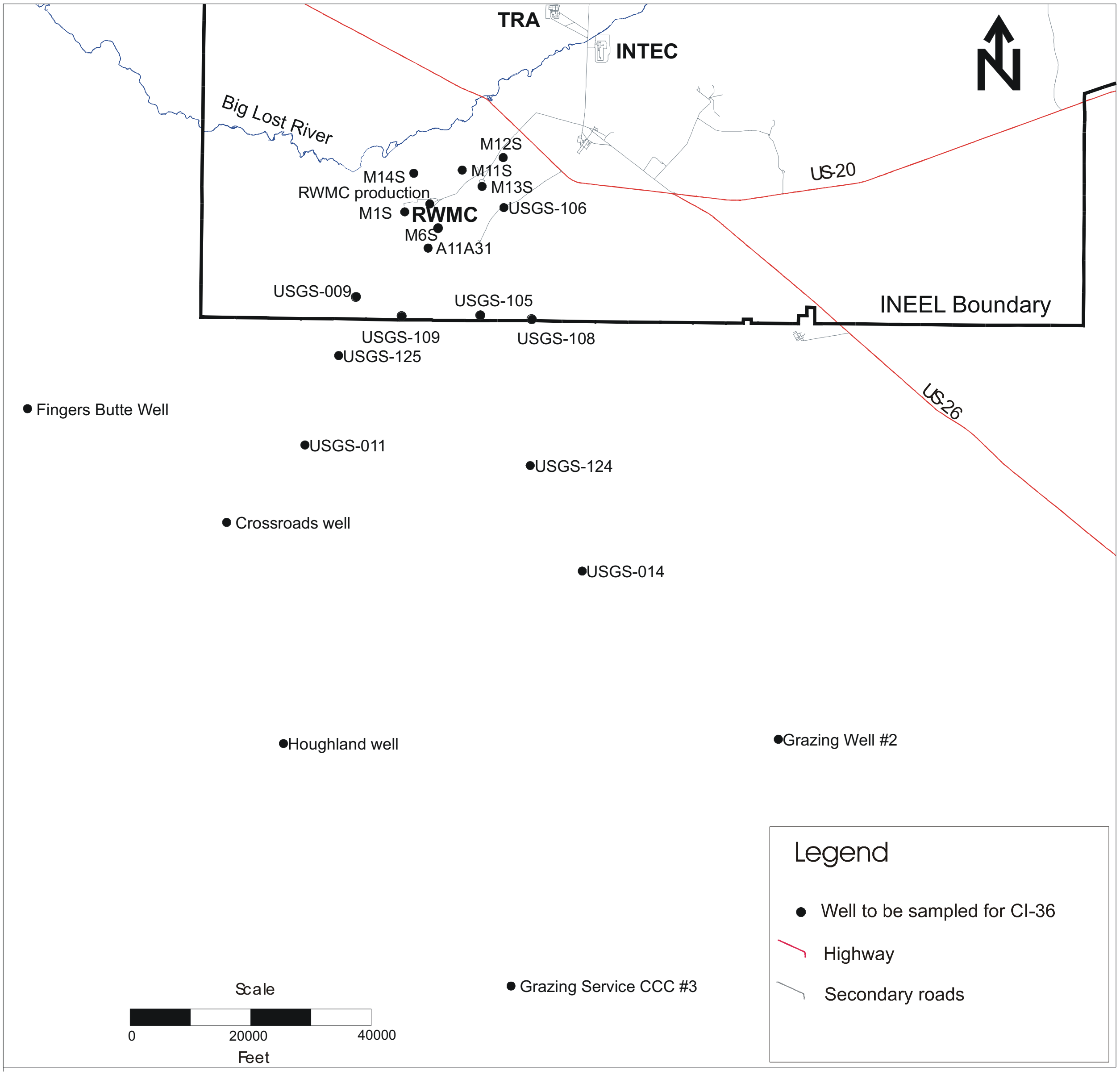

Figure 4-3. Wells to be sampled for Cl-36.

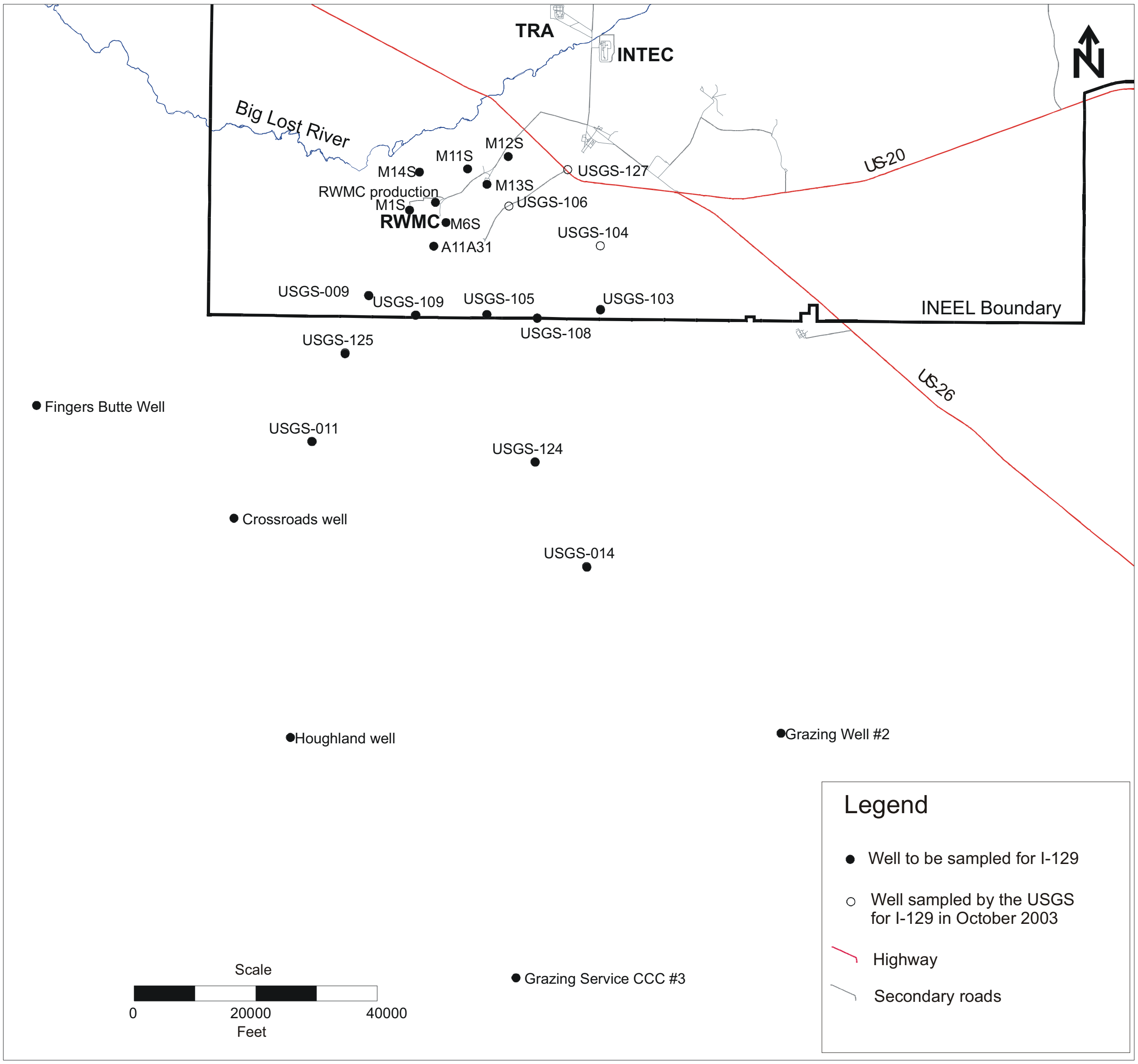

Figure 4-4. Wells to be sampled for I-129 (note that wells sampled by the USGS near INTEC are not shown on this figure).

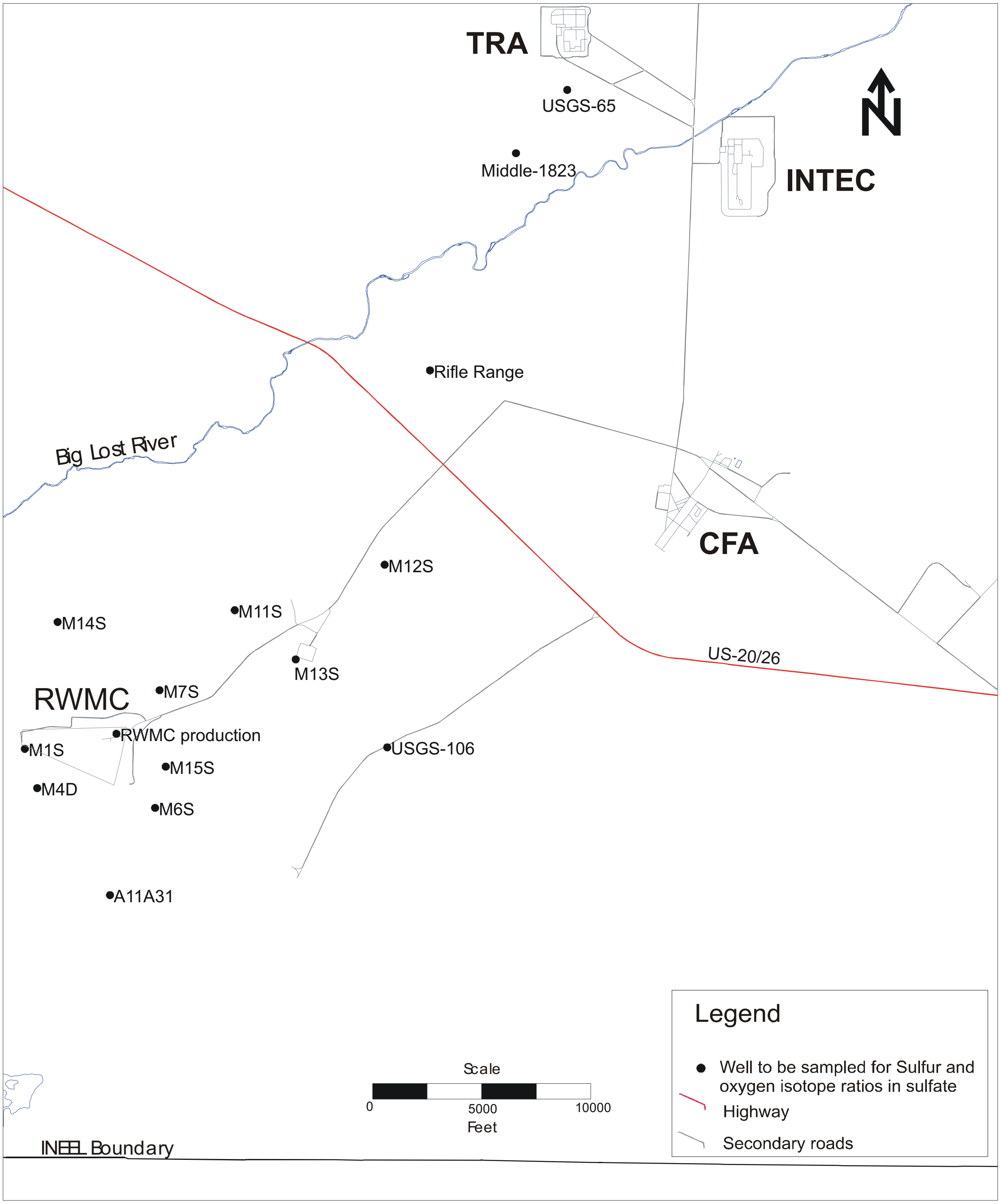

Figure 4-5. Wells to be sampled for sulfur and oxygen isotope ratios in sulfate.

In addition to the above wells, a perched well and two lysimeters within the RWMC will be sampled if enough water is available. Lysimeters D06-DL01 and D06-DL02 are proposed to be sampled to obtain $\delta^{34}S$ and $\delta^{18}O$ signatures for uranium contamination from the RWMC. These two lysimeters have high sulfate concentrations and anomalously high uranium concentrations. In addition, perched well 8802D is proposed to be sampled, because it has been impacted by the magnesium chloride brine applied to the roads.

4.2.3 Nitrogen and Oxygen Isotope Ratio in Nitrate

The objective of the nitrogen and oxygen isotope ratio in nitrate study is to track the influence of the nitrate contamination from INTEC to south of CFA. The INTEC nitrate plume has been tracked into the CFA area (ICP 2004b). Recent data for nitrogen and oxygen isotope ratios in nitrate have indicated that the nitrate plume from INTEC has a distinct signature versus natural nitrate in the SRPA (ICP 2004b). The $\delta^{18}O$ values for the nitrate in the CFA landfill wells show a shift that is inconsistent with a natural source and a sewage source, but the values are consistent with a source at INTEC (ICP 2004b). Although dilution could obscure the interpretation of the nitrogen and oxygen isotope ratios in nitrate as the nitrate plume migrates south of CFA, the nitrogen and oxygen isotope data might help to clarify the origin of an anion anomaly present on the south side of the RWMC (DOE-ID 2004e).

The wells to be sampled for nitrogen and oxygen isotope ratios in nitrate are listed in Table 4-4 and shown on Figure 4-6. USGS-106 and M12S were selected, because they are probably within the INTEC plume and should yield a downgradient signature for it. The M7S, M14S, and RWMC production wells were selected, because they are contaminated with tritium that could be from INTEC, RWMC, or TRA. Wells M6S and M15S were selected, because these wells are within the anion anomaly south of the RWMC and because M6S has nitrate concentrations above local background conditions. Well M11S was chosen, because it is located outside the tritium anomaly and the anion anomaly and should yield background ratios. The Rifle Range Well is located between TRA and RWMC and might yield information on the influence of TRA and INTEC at this location.

4.2.4 Additional Analyses in Support of the Geochemical Study

Data for metals, including common cations and anions, are needed for corroborating the interpretation of the Cl-36, I-129, sulfur isotope, and nitrogen isotope data. Metals and anions data collected for WAG 7 and the routine OU 10-08 sampling will be used for most wells, but a few wells not routinely sampled by WAGs 7 and 10 will need to be sampled. The anion and metal analytes are the same as those on the routine OU 10-08 monitoring list. In addition to metals and anions, total alkalinity will be analyzed for these same wells. The wells to be sampled for metals, anions, and alkalinity are listed in Table 4-4.

4.2.5 Low-detection Limit VOC Analysis

Wells USGS-009, -105, -109, and -125 will be sampled for carbon tetrachloride, dichlorodifluoromethane (F-12), trichloroethene, and 1,1,2-trichloro-1,2,2-trifluoroethane (F-113) and analyzed using a low-detection limit (approximately 0.01 to 0.001 μg/L) VOC analysis method. This analysis is in addition to the standard analytical method for VOCs. The locations of these four wells are shown on Figure 4-1. The goal of the low-detection limit sampling is to evaluate migration paths from the RWMC and the potential for plumes from the RWMC to mix with plumes from INTEC and TRA.

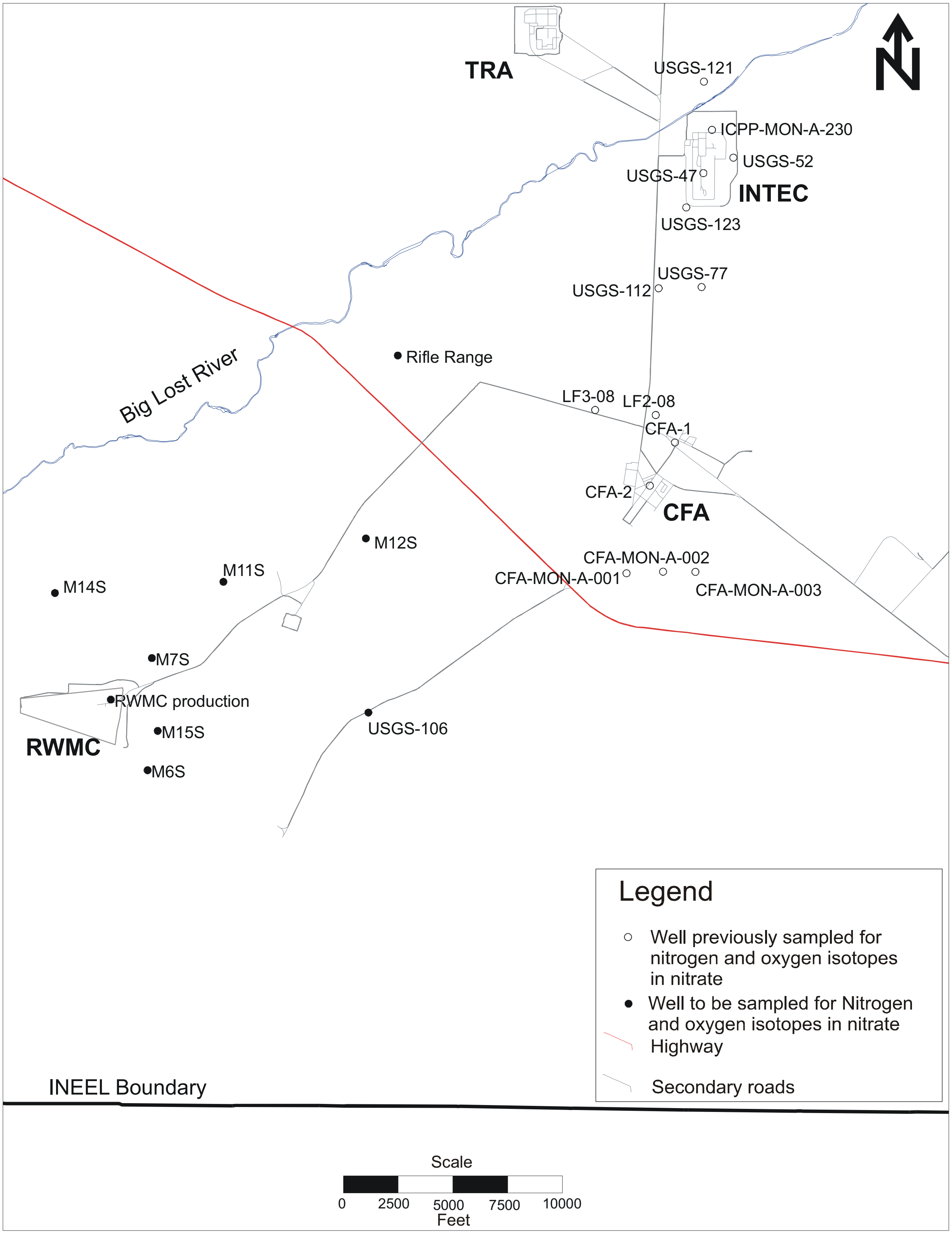

Figure 4-6. Wells to be sampled for nitrogen and oxygen isotope ratios in nitrate.

The four analytes were selected for the low-detection limit analysis, because carbon tetrachloride and trichloroethene are COCs for the RWMC, and F-12 and F-113 were previously detected at very low concentrations. A low-detection limit study by the USGS identified a very low-concentration F-113 plume that appears to originate at the RWMC, extend past the southern boundary of the INEEL site, and overlap with an F-12 plume (Busenberg et al. 2001). This sampling will only be performed if a laboratory that is capable of doing the analyses can be found.

4.2.6 Geochemical Study Sampling Schedule

In contrast to the routine/annual sampling described in Subsection 4.1, the geochemical study is a one-time sampling event that will occur from May through July 2005. Most samples will be collected by co-sampling during regularly scheduled WAG-specific sampling activities. Because turnaround time for the AMS results is not guaranteed, the data collected in 2005 as part of the geochemical study will be presented in an engineering design file in FY 2006 rather than being included in the FY 2005 annual RI/FS monitoring report.

4.3 Sampling Quality Assurance/Quality Control and Performance Evaluation Samples

Section 6 of this plan and the QAPjP (DOE-ID 2004a) require quality assurance/quality control (QA/QC) samples from the SRPA samples. Laboratories approved by SAM will be used for the analyses of all such samples. QA/QC samples will be collected at the frequency recommended in the QAPjP. QA/QC samples for the groundwater sampling will include duplicates and might include rinsate samples. Duplicate samples will be collected at a frequency of 1 per 20 samples. Thus, two duplicates are planned for each routine sampling event, because 27 wells will be sampled.

Performance evaluation (PE) samples might also be sent to the laboratory(ies) during the sampling event. The PE samples might be spiked with a single analyte or multiple analytes. The need for the PE samples will be evaluated before each sampling event.

4.4 Water Level Measurement Locations and Schedule

Water level measurements are scheduled for June of each year. The wells proposed for water level measurements are listed on Table A-1 and shown on the map provided in Appendix A. The water level measurements will generally be collected in a two-week period. However, a few wells may be measured outside this period if weather conditions, well access problems, or other factors prevent water levels from being measured on schedule.

The water level measurement list includes wells screened at the water table, vertical gradient wells, and wells open over large intervals that are being monitored as part of individual WAG monitoring plan requirements. In addition, perched water levels will be measured in 15 wells to help meet the monitoring needs for WAG 2. The water level measurement list is approximate, and the number of wells measured each year may vary, because some wells might be inaccessible or undergoing maintenance. The water level data will be corrected for borehole deviation and presented in the annual OU 10-08 RI/FS monitoring report.

Water levels will be measured with an electronic measuring tape (Solinist brand or equivalent) or a steel tape measure scaled in feet with markings to 0.01 ft. Water level measurements will be recorded to the nearest 0.01 ft. Water levels will be measured according to the latest INEEL procedure.

Wells screened in the upper 50 ft of the SRPA will be given priority in producing a sitewide groundwater level map; these wells are listed in Table A-2 of Appendix A. The shallow wells in the upper 50 ft of the SRPA are given priority for producing a groundwater level map to minimize the effects of hydraulic head variance over large open intervals. The criteria for prioritizing wells might change after analysis of vertical gradients following installation of new WAG 10 monitoring wells (ICP 2004a). In areas with little spatial coverage from the priority well list, additional wells might be used to complete the water table map. Table A-3 in Appendix A lists well pairs that could provide information on vertical gradients. From the data in Table A-3, it is apparent that significant vertical gradients exist; consequently, water levels in wells with large open intervals might represent a composite value for the open interval. Thus, these wells might not be representative of water table conditions. Wells located a considerable distance from other wells might be used for the groundwater level map, because it is likely that the hydraulic head difference between wells due to the horizontal gradient is much greater than the difference due to vertical gradients. This assumption will need to be evaluated on an individual well basis. The decision to use non-priority well data or data from areas with little spatial coverage will depend on a review of the actual locations where a measurement was taken. Vertical gradients will be evaluated for the locations listed in Appendix A. The vertical gradient data will also be used for calibrating the OU 10-08 groundwater model.

5. GROUNDWATER SAMPLING PROCEDURES AND EQUIPMENT

This section describes procedures and the equipment to be used for routine OU 10-08 sampling and monitoring and for the geochemical study. Before any sampling begins, a pre-sampling meeting will be held to review the requirements of this plan, the HASP (INEEL 2004), and applicable company policies and procedures and to ensure that all supporting documentation has been completed. Figure 4-1 shows the wells to be sampled as part of the routine OU 10-08 sampling, and Figures 4-3 through 4-6 show the locations of wells to sampled for the geochemical study.

5.1 Groundwater Elevations

Prior to sampling, all groundwater elevations will be measured using either an electronic measuring tape (Solinist brand or equivalent) or a steel tape measure, as described in the latest INEEL standard operating procedure. Measurement of all water levels will be recorded to the nearest 0.01 ft.

5.2 Well Purging

Before collecting a sample from any aquifer water well, the well must be purged. During the purging operation, a Hydrolab (or equivalent) will be used to measure specific conductance, pH, and temperature. The pH, temperature, and specific conductance readings will be compiled from the logbooks and used in the geochemical analysis. Well purging will follow the latest INEEL procedure. A sample for water quality analysis can be collected after a minimum of three well casing volumes of water have been purged from the well and when three consecutive water-quality parameter measurements separated by at least 10% of the purge volume or 5 minutes are within the following limits:

- pH $\pm$ 0.1
- Temperature $\pm$ 0.5°C
- Specific conductance $\pm$ 10 µmhos/cm.

5.3 Groundwater Sampling

Prior to sampling, all nondedicated sampling equipment that will come in contact with the water sample will be cleaned using the latest INEEL procedure for decontamination of field sampling equipment. After sampling, all nondedicated equipment that came in contact with the well water will be decontaminated before storage per the latest INEEL procedure.

Prior to purging, the water level in each well will be measured. The well will then be purged a minimum of three well-casing volumes until the pH, temperature, and specific conductance of the purge water have stabilized or until a maximum of four well-casing volumes have been removed. If parameters are still not stable after four volumes have been removed, samples will be collected and appropriate notations will be recorded in the logbook.

Routine groundwater samples will be analyzed for the analytes listed in Table 4-3. The requirements for containers, preservation methods, sample volumes, holding times, and analytical methods will be in the laboratory statement of work to be prepared before sampling.

Except for volatile organic analyte vials that need to be filled completely, sample bottles will be filled to approximately 90 to 95% of capacity to allow for content expansion or preservation. Samples to be analyzed for metals (target analyte list metals plus boron) will be filtered through a 0.45-µm filter in the field prior to acidification. Samples requiring acidification will be acidified to a pH <2 in the field.

5.4 Personal Protective Equipment

The personal protective equipment (PPE) required for this sampling effort is discussed in the project HASP (INEEL 2004). Before disposal, all PPE will be characterized for disposal or decontamination based on groundwater and field screening results. A hazardous waste determination for all PPE will be made using applicable company policies and procedures.

6. SAMPLE CONTROL

Strict sample control is required for any project. Sample control ensures that unique sample identifiers are used for separate samples. It also covers the documentation of sample collection information so that a sampling event can be reconstructed at a later date. The following subsections provide details about sample designation, handling, shipping, and radiological screening.

6.1 Sample Designation

A systematic code is crucial for the unique identification of samples. Uniqueness is required for maintaining consistency within a project and preventing the same identification code from being assigned to more than one sample.

6.1.1 Sample Identification Code

A systematic character identification code will be used to uniquely identify all samples. The first three designators of the code (i.e., GWM) indicate that the sample originated from groundwater monitoring activities. The next three numbers designate the sequential sample number for the project. The seventh and eighth characters represent a two-character set (e.g., 01, 02) for designation of field duplicate samples. The last two characters refer to a particular analysis and bottle type.

For example, a groundwater sample collected in support of the OU 10-08 monitoring might be designated as GWM00101AN, where (from left to right):

- GWM designates the sample as being collected for OU 10-08
- 001 designates the sequential sample number
- 01 designates the type of sample (01 = original, 02 = field duplicate)
- AN designates anion analysis.

A sampling and analysis plan (SAP) table/database will be prepared before sampling and used to record all pertinent information (e.g., well designation, media, and date) associated with each sample identification code.

6.1.2 Sampling and Analysis Plan Table/Database

6.1.2.1 General. A SAP table format was developed to simplify the presentation of the sampling scheme for project personnel. The following subsections describe the information recorded in the SAP table/database.

6.1.2.2 Sample Description Fields. The sample description fields contain the following information about individual sample characteristics:

- ***Sampling Activity***—The sampling activity field contains the first six characters of the assigned sample number. The sample number in its entirety will be used to link information from other sources (e.g., field data and analytical data) to the information in the SAP table for data reporting, sample tracking, and completeness reporting. The sample number will also be used by the analytical laboratory to track and report analytical results.

- ***Sample Type***—Data in this field will be selected from the following:
  - REG for a regular sample
  - QC for a quality control sample.
- ***Media***—Data in this field will be selected from the following:
  - GROUNDWATER for water collected from groundwater
  - WATER for regular and QA/QC samples of groundwater.
- ***Collection Type***—Data in this field will be selected from the following:
  - GRAB for grab samples (undisturbed and disturbed core sample)
  - FBLK for field blanks
  - RNST for rinsates
  - DUP for duplicates
  - TBLK for volatile organic analyte trip blanks.
- ***Sampling Method***—Data in this field are related to what the sample is taken from. This field can be left blank.

6.1.2.3 Planned Date. This date is related to the planned sample collection start date.

6.1.2.4 Sample Location Fields. This group of fields pinpoints the exact location for the sample in three-dimensional space, starting with the general area, narrowing the focus to an exact location geographically, and then specifying the depth in the depth field, as follows:

- ***Area***—The area field identifies the general sample collection area. This field should contain the standard identifier for the INEEL area being sampled. For this investigation, samples are being collected from sites designated as WAG 10 OU 10-08 groundwater. The area field identifier will correspond to this site.

- ***Location***—This field generally contains program-specific information such as the borehole or well identification number but can contain geographical coordinates, x-y coordinates, building numbers, or other location-identifying details. Data in this field will normally be subordinate to the area. This information is included on the labels generated by SAM to aid field sampling personnel.

- ***Type of Location***—This field supplies descriptive information about the exact sample location. Information in this field can overlap with that in the location field, but the information is intended to add detail about the location.

- ***Depth***—The depth of a sample location is the distance in feet from ground surface or a range in feet from the surface.

6.1.2.5 Analysis Types

- ***AT1–AT20***—These fields indicate analysis types (e.g., radiological and chemical) and the number to be collected for each sample number. Space is provided at the bottom of the form to clearly identify each type. A standard abbreviation is also provided for each analysis below the Analysis Types cell.

6.2 Sample Handling

Samples for laboratory analyses will be collected in pre-cleaned containers and packaged according to American Society for Testing and Materials, or EPA-recommended, procedures. The quality assurance samples will be included to satisfy the QA/QC requirements for the field operation, as outlined in the QAPjP (DOE-ID 2004a). Qualified (SAM-approved) laboratories will analyze the samples.

6.2.1 Sample Preservation

Immediately after collection and survey by the radiological control technician, all groundwater, rinsate, and QA/QC samples will be placed in coolers containing frozen, reusable ice packs or ice. Samples that require cooling will be maintained at 4°C (39°F) immediately after sample collection through sample shipment. After preservation, sample coolers will have chain-of-custody (CoC) seals attached.

6.2.2 Chain-of-Custody Procedures

The CoC forms will be completed following applicable company procedures and the QAPjP (DOE-ID 2004a). Sample containers will be stored in a secured area accessible only to the field team members.

6.2.3 Transportation of Samples

Samples will be shipped in accordance with the regulations issued by the Department of Transportation (DOT) (49 CFR 171 through 178) and EPA sample-handling, -packaging, and -shipping methods (40 CFR 261.3). Samples will be packaged in accordance with the requirements set forth in company policies and procedures.

6.2.3.1 Custody Seals. Custody seals will be placed on all shipping containers in a way that ensures tampering or unauthorized opening does not compromise sample integrity. Clear plastic tape will be placed over the seals to ensure that they are not damaged during shipment.

6.2.3.2 On- and Off-Site Shipping. An on-Site shipment is any transfer of material within the perimeter of the INEEL site. Site-specific requirements for transporting samples within INEEL site boundaries and those required by the shipping and receiving department will be followed. Shipment within the INEEL site boundaries will conform to DOT requirements as stated in 49 CFR. Off-site sample shipment will be coordinated with Packaging and Transportation personnel, as necessary, and will conform to all applicable DOT requirements.

7. QUALITY ASSURANCE/QUALITY CONTROL

A QAPjP has been developed for WAGs 1, 2, 3, 4, 5, 6, 7, and 10 (DOE-ID 2004a). The QAPjP pertains to all environmental and radiological testing, analysis, and data review. This section details the field elements of the QAPjP to support field operations during implementation of this field sampling plan.

7.1 Project Quality Objectives

Quality assurance objectives specify the measurements that must be met to produce acceptable data for a project. The technical and statistical qualities of those measurements must be properly documented. Precision, accuracy, and completeness are quantitative parameters that must be specified for physical/chemical measurements. Comparability and representativeness are qualitative parameters.

Quality assurance objectives for this project will be met through a combination of field and laboratory checks. Field checks will consist of collecting field duplicates, equipment blanks, and field blanks. Laboratory checks consist of initial and continuing calibration samples, laboratory control samples, matrix spikes, and matrix spike duplicates. Laboratory quality assurance is detailed in the QAPjP (DOE-ID 2004a) and is beyond the scope of this plan.

7.1.1 Field Precision

Field precision is a measure of the variability not due to laboratory or analytical methods. The three types of field variability or heterogeneity are spatially within a data population, between individual samples, and within an individual sample. Although the heterogeneity between and within samples can be evaluated using duplicate and/or sample splits, overall field precision will be calculated as the relative percent difference between two measurements or the relative standard deviation between three or more measurements. The relative percent difference or relative standard deviation will be calculated as indicated in the QAPjP (DOE-ID 2004a) for duplicate samples during the data validation process. Precision goals have been established for inorganic Contract Laboratory Program methods by the EPA (EPA 1993) and for radiological analyses in the applicable SAM procedures.

Duplicate samples to assess precision will be collocated and collected by field personnel at a minimum frequency of one duplicate for every 20 samples, with the location of the QA/QC samples being rotated between sampling events.

7.1.2 Field Accuracy

Cross contamination of the samples during collection or shipping could yield incorrect analytical results. To assess the occurrence of any cross contamination, equipment blanks and field blanks will be collected. The goal of the sampling program is to eliminate any cross contamination associated with sample collection or shipping. Analytical results for these samples will be evaluated during the data validation process by sample delivery group. If necessary, the data will be blank-qualified to indicate the absence or presence of cross contamination.

Field personnel will collect rinsate, equipment, and field blanks during the course of the project. The rinsate, equipment, and field blanks will be collected at a frequency of one every 20 samples or once for every sample day, whichever is less (DOE-ID 2004a). If activities that could contaminate the samples are identified during sampling, additional blank samples can be collected at the discretion of the FTL.

7.1.3 Representativeness

Representativeness is evaluated by assessing the accuracy and precision of the sampling program and expressing the degree to which samples represent actual site conditions. In essence, representativeness is a qualitative parameter that addresses whether the sampling program was properly designed to meet the DQOs. The representativeness criterion is best satisfied by confirming that a sufficient number of samples is collected to meet the requirements stated in the DQOs. The DQOs are identified in Section 3 of this plan.

7.1.4 Comparability

Comparability is a qualitative measure of the confidence with which one data set can be compared to another. These data sets include data generated by different laboratories performing this work, data generated by laboratories in previous studies, data generated by the same laboratory over a period of several years, or data obtained using differing sampling techniques or analytical protocols. For field aspects of this program, data comparability will be achieved using standard methods of sample collection and handling. Procedures identified to standardize the sample collection and handling are included in applicable company policies and procedures.

7.1.5 Completeness

Field completeness will be assessed by comparing the number of samples collected to the number of samples planned. Field sampling completeness is affected by such factors as equipment and instrument malfunctions and insufficient sample recovery. Completeness can be assessed after data validation and reduction. The completeness goal for this project is 90%.

7.2 Data Validation

All laboratory-generated data, except for stable isotope data and low-detection limit I-129 and Cl-36 data, will be validated to Level B; however, a Level A data package will be requested from the laboratory. Data will be validated in accordance with company procedures. Field-generated data (e.g., conductivity, temperature, dissolved oxygen, and pH) will be validated through the use of properly calibrated instrumentation, comparing and cross checking data with independently gathered data and recording data-collection activities in a bound field logbook.

7.3 Quality Assurance Objectives for Measurement

The quality assurance objectives are specifications that the monitoring and sampling measurements identified in the QAPjP (DOE-ID 2004a) must meet to produce acceptable data for the project. The technical and statistical quality of these measurements must be properly documented. Precision, accuracy, method detection limits, and completeness must be specified for chemical measurements. Quality assurance objectives are specified in the QAPjP for WAGs 1, 2, 3, 4, 5, 6, 7, and 10 (DOE-ID 2004a).

8. PROJECT ORGANIZATION AND RESPONSIBILITIES

The organizational structure for this project reflects the resources and expertise required to perform the work while minimizing the risks to worker health and safety. Key project positions at the INEEL and within the Balance of INEEL Cleanup Program structure are outlined in the HASP (INEEL 2004). The HASP is divided into two sections that outline the responsibilities of key INEEL cleanup project personnel. The HASP also discusses key personnel who will be directly associated with the job site (i.e., on-site personnel).

9. WASTE MANAGEMENT

The disposition of investigation-derived waste will be coordinated with the appropriate Waste Generator Services (WGS) interface to ensure compliance with applicable waste-storage, -characterization, -treatment, and -disposal requirements.

Investigation-derived waste produced during sampling will include spent and unused sample material, PPE, miscellaneous sampling supplies, decontamination water, purge water, and samples. WGS will provide a determination for the disposition of all waste, including purge water, based on a waste determination and disposition form. In addition, Appendix G of the OU 10-08 RI/FS work plan (DOE-ID 2002a) includes instructions for handling investigation-derived waste for this project.

Before sampling begins, the project will provide the field team with the WGS determination and waste disposition form for each well. That form describes the required disposal option for purge water. Purge water from most of the wells to be sampled under this plan is anticipated to be eligible for release to the ground surface. In addition, to help ensure the purge volume is correct, the project will provide samplers with the approximate volume of water purged from the well during a previous sampling round.

If the purged groundwater must be containerized for specific wells because of radionuclides, chemicals, or regulatory restrictions, then the well will not be sampled until a disposal option is available. If possible, for example, sites that have specific purge water disposal restrictions will be sampled concurrently with other programs or WAGs to eliminate duplication and provide the most efficient and compliant management of purge water by those programs.

10. HEALTH AND SAFETY

A HASP has been prepared to define the health and safety requirements for this project (INEEL 2004). The HASP establishes the procedures and requirements that will be used to minimize health and safety risks to persons working on the OU 10-08 project. The HASP meets the requirements of 29 CFR 1910.120 and 29 CFR 1926.65. Preparation of the HASP was consistent with information found in the following documents:

- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (NIOSH/OSHA/USCG/EPA 1985)

- Company manuals.

The HASP governs all work that is performed by INEEL personnel and INEEL subcontractors or employees of other companies in support of OU 10-08. Persons not normally assigned to work at the site—such as representatives of DOE, DOE Idaho, the State of Idaho, the Occupational Safety and Health Administration, and EPA—are considered occasional workers, as stated in 29 CFR 1910.120 and 29 CFR 1926.65.

11. DOCUMENT MANAGEMENT

This section summarizes document-management and sample-control activities that will be performed during this project. Documentation includes CoC forms, sample container labels, and field logbooks used to record field data and sampling procedures. The analytical results from this field investigation will be documented in reports and used as input for refining the current conditions for the computer model.

11.1 Documentation

The FTL will be responsible for controlling and maintaining all field documents and records and for verifying that all required documents submitted to INEEL SAM are maintained in good condition. All entries will be made in indelible black ink. Errors will be corrected by drawing a single line through the error and entering the correct information. All corrections will be initialed and dated by the person making the correction.

11.1.1 Sample Container Labels

Waterproof, gummed labels generated from the SAP database will display information such as the unique sample identification number, the name of the project, the sample location, and the analysis type. Labels will be completed and placed on the containers in the field before collecting the sample. Sample team members will provide information needed to complete the label. Such information may include the date and time the sample was collected, the preservative used, field measurements of hazards, and the sampler's initials.

11.1.2 Field Guidance Form

Field guidance forms verifying unique sample numbers provided for each sample location can be generated from the SAP database. These forms contain the following information:

- Media
- Sample identification numbers
- Sample location
- Aliquot identification
- Analysis type
- Container size and type
- Sample preservation.

11.1.3 Field Logbooks

Field logbooks will be used to record information necessary to interpret the analytical data in accordance with the SAM format, and the logbooks will be controlled and managed in accordance with company policies and procedures.

11.1.3.1 FTL's Daily Logbook. A project logbook maintained by the FTL will contain a daily summary of the following:

- All field team activities necessary to reconstruct the events and methods used to accomplish the objectives of this field sampling plan
- Visitor log (a site visitor logbook can be assigned to record this information)
- List of site contacts
- Problems encountered
- Corrective actions taken as a result of field audits.

The project logbook will be signed and dated at the end of each day's sampling activities.

11.1.3.2 Sample Logbooks. Sample logbooks will be used by the sample team(s). Each sample logbook will contain information such as the following:

- Physical measurements
- Identification of quality control samples
- Sample information (i.e., sample location, sample collection information, analyses requested for each sample, and sample matrix)
- Shipping information (i.e., collection dates, shipping dates, cooler identification number, destination, CoC number, and name of shipper).

11.1.3.3 Field Instrument Calibration/Standardization Logbook. A logbook containing records of calibration data will be maintained for each piece of equipment that requires periodic calibration or standardization. This logbook will contain logsheets to record the date and time of calibration, the method of calibration, and the instrument identification number.

11.1.4 Photographs

No formal photographic records of the activities conducted under this plan are expected to be made. Field personnel can take photographs to record general equipment setups and installation procedures. A minimum of two copies will be made of any photographs taken during this project. One copy will be placed in the project file. The second copy will accompany other project documents (i.e., field logbooks) to be placed in the Document Control and Records Management files.

11.2 Document Revision Requests

Currently, at least one revision of this plan is anticipated in order to include two new WAG 10 wells to be drilled in FY 2005. Other revisions might be required in order to incorporate new ultra-low detection methods, if they become available, for tritium and Tc-99. It might also be necessary to revise this document to add or delete wells, depending on the results and interpretation of data collected under this plan or the results of groundwater monitoring by other WAGs or agencies. Revisions of this document will follow company policies and procedures. Final changes must also be approved through the supervising regulatory agencies, because this is a secondary FFA/CO document.

12. REFERENCES

29 CFR 1910.120, 2004, "Hazardous Waste Operations and Emergency Response," *Code of Federal Regulations*, Office of the Federal Register, July 2004.

29 CFR 1926.65, 2004, "Hazardous Waste Operations and Emergency Response," *Code of Federal Regulations,* Office of the Federal Register, July 2004.

40 CFR 261.3, 2004, "Definition of Hazardous Waste," *Code of Federal Regulations*, Office of the Federal Register, July 2004.

40 CFR 300, 2004, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*, Office of the Federal Register, July 2004.

49 CFR 171, 2003, "General Information, Regulations, and Definitions," *Code of Federal Regulations,* Office of the Federal Register, October 2003.

49 CFR 172, 2003, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements," *Code of Federal Regulations*, Office of the Federal Register, October 2003.

49 CFR 173, 2003, "Shippers General Requirements for Shipments and Packaging," *Code of Federal Regulations,* Office of the Federal Register, October 2003.

49 CFR 174, 2003, "Carriage by Rail," *Code of Federal Regulations*, Office of the Federal Register, October 2003.

49 CFR 175, 2003, "Carriage by Aircraft," *Code of Federal Regulations*, Office of the Federal Register, October 2003.

49 CFR 176, 2003, "Carriage by Vessel," *Code of Federal Regulations*, Office of the Federal Register, October 2003.

49 CFR 177, 2003, "Carriage by Public Highway," *Code of Federal Regulations*, Office of the Federal Register, October 2003.

49 CFR 178, 2004, "Specifications for Packaging," *Code of Federal Regulations,* Office of the Federal Register, January 2004.

54 FR 48184, 1989, "National Priorities List of Uncontrolled Hazardous Waste Sites; Final Rule," *Federal Register*, U.S. Environmental Protection Agency, November 21, 1989.

42 USC § 6901 et seq., 1976, "Resource Conservation and Recovery Act (Solid Waste Disposal Act)," *United States Code*, October 21, 1976.

42 USC § 9601 et seq., 1980, "Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA/Superfund)," *United States Code,* December 11, 1980.

Bartholomay, R. C., and B. V. Twining, 2000, *Radiochemical and Chemical Constituents in Water from the Southern Boundary of the Idaho National Engineering and Environmental Laboratory to the Hagerman Area, Idaho 1999*, U.S. Geological Survey Open File Report 00-399.

Bartholomay, R. C., B. J. Tucker, L. L. Knobel, and L. J. Mann, 2001, *Radiochemical and Chemical Constituents in Water from Selected Wells South of the Idaho National Engineering and Environmental Laboratory, Idaho*, U.S. Geological Survey Open File Report 01-138.

Beasley, T. M., P. R. Dixon, and L. J. Mann, 1998, "^{99}Tc, ^{236}U, and ^{237}Np in the Snake River Aquifer at the Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho," *Environmental Science and Technology*, Vol. 32, No. 24, pp. 3875–3881.

Beasley, T. M., L. D. Cecil, P. Sharma, P. W. Kubik, U. Fehn, L. J. Mann, and H. E. Gove, 1993, "^{36}Cl in the Snake River Plain Aquifer at the Idaho National Engineering Laboratory: Origin and Implications," *Ground Water*, Vol. 31, No. 2, pp. 302–310.

Busenberg, E., L. N. Plummer, and R. C. Bartholomay, 2001, *Estimated Age and Source of the Young Fraction of Ground Water at the Idaho National Engineering and Environmental Laboratory*, USGS Water Resources Investigations Report 01-4265.

Cecil, L. D, L. F. Hall, and J. R. Green, 2003, *Reevaluation of Background Iodine-129 Concentrations in Water from the Snake River Plain Aquifer, Idaho*, USGS Water Resources Investigations Report 03-4106.

Cecil, L. D, J. A. Welhan, J. R. Green, S. K. Grape, and E. R. Sudicky, 2000, "Use of Chlorine-36 to Determine Regional-scale Aquifer Dispersivity, Eastern Snake River Plain Aquifer, Idaho/USA," *Nuclear Instruments and Methods in Physics Research*, B 172, pp. 679–687.

DOE-ID, 1991, *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory,* U.S. Department of Energy Idaho Operations Office, U.S. Environmental Protection Agency, and Idaho Department of Health and Welfare, December 1991.

DOE-ID, 1992a, *Record of Decision—Technical Support Facility (TSF) Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23)*, U.S. Department of Energy Idaho Operations Office, U.S. Environmental Protection Agency, and Idaho Department of Health and Welfare, September 1992.

DOE-ID, 1992b, *Record of Decision for Operable Unit 2-12, TRA Perched Water System*, U.S. Department of Energy Idaho Operations Office, U.S. Environmental Protection Agency, and Idaho Department of Health and Welfare, December 1992.

DOE-ID, 1995a, *Record of Decision—Technical Support Facility (TSF) Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites Final Remedial Action*, U.S. Department of Energy Idaho Operations Office, U.S. Environmental Protection Agency, and Idaho Department of Health and Welfare, August 1995.

DOE-ID, 1995b, *Record of Decision Declaration for Central Facilities Area Landfills I, II, and III (Operable Unit 4-12), and No Action Sites (Operable Unit 4-03)*, U.S. Department of Energy Idaho Operations Office, U.S. Environmental Protection Agency, and Idaho Department of Health and Welfare, October 1995.

DOE-ID, 1997, *Final Record of Decision—Test Reactor Area, OU 2-13, Idaho National Engineering and Environmental Laboratory*, DOE/ID-10586, U.S. Department of Energy Idaho Operations Office, U.S. Environmental Protection Agency, and Idaho Department of Health and Welfare, December 1997.

DOE-ID, 1999a, *Record of Decision—Test Area North*, *OU 1-10*, U.S. Department of Energy Idaho Operations Office, U.S. Environmental Protection Agency, and Idaho Department of Health and Welfare, October 1999.

DOE-ID, 1999b, *Final Record of Decision (ROD) Idaho Nuclear Technology and Engineering Center (INTEC) Operable Unit (OU) 3-13*, DOE/ID-10660, Rev. 0, U.S. Department of Energy Idaho Operations Office, U.S. Environmental Protection Agency, and Idaho Department of Health and Welfare, October 1999.

DOE-ID, 2000, *Comprehensive Remedial Investigation/Feasibility Study for the Central Facilities Area Operable Unit 4-13 at the Idaho National Engineering and Environmental Laboratory*, DOE/ID-10680, Rev. 1, U.S. Department of Energy Idaho Operations Office, July 2000.

DOE-ID, 2002a, *Waste Area Group 10, Operable Unit 10-08, Remedial Investigation/Feasibility Study Work Plan (FINAL)*, DOE/ID-10902, Rev. 0, U.S. Department of Energy Idaho Operations Office, August 2002.

DOE-ID, 2002b, *Record of Decision Experimental Breeder Reactor-I/Boiling Water Reactor Experiment Area and Miscellaneous Sites Operable Units 6-05 and 10-04 Idaho National Engineering and Environmental Laboratory*, DOE/ID-10980, Rev. 0, U.S. Department of Energy Idaho Operations Office, November 2002.

DOE-ID, 2004a, *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Deactivation, Decontamination, and Decommissioning*, DOE/ID-10587, Rev. 8, U.S. Department of Energy Idaho Operations Office, March 2004.

DOE-ID, 2004b, *Waste Area Group 10, Operable Unit 10-08, Remedial Investigation/Feasibility Study Annual Report for Fiscal Year 2003,* DOE/ID-11116, Rev. 0, U.S. Department of Energy Idaho Operations Office, April 2004.

DOE-ID, 2004c, *Waste Area Group 10, Operable Unit 10-08, Remedial Investigation/Feasibility Study Supplemental Annual Report for Fiscal Year 2003,* DOE/NE-ID-11116 SUPP, Rev. 0, U.S. Department of Energy Idaho Operations Office, August 2004.

DOE-ID, 2004d, *Second Addendum to the Work Plan for the OU 7-13/14 Waste Area Group 7 Comprehensive Remedial Investigation/Feasibility Study,* DOE/ID-11039, Rev. 0, U.S. Department of Energy Idaho Operations Office, August 2004.

DOE-ID, 2004e, *Idaho National Engineering and Environmental Laboratory Operable Unit 10-08, Sitewide Groundwater Model Work Plan*, DOE/ID-11188, Rev. 0, U.S. Department of Energy Idaho Operations Office, December 2004.

DOE-ID, 2005, *Waste Area Group 10, Operable Unit 10-08, Remedial Investigation/Feasibility Study Annual Status Report for Fiscal Year 2004*, DOE/NE-ID-11198, Rev. 0, U.S. Department of Energy Idaho Operations Office, March 2005.

EPA, 1993, "Statement of Work for Inorganic Analysis—Multi-media, Multi-Concentration, Contract Laboratory Program," ILM03.0, U.S. Environmental Protection Agency, June 1993.

EPA, 2000, "Guidance for the Data Quality Objective Process," EPA QA/G-4, U.S. Environmental Protection Agency, August 2000.

Hull, L. C., and C. W. Bishop, 2003, *Fate of Magnesium Chloride Brine Applied to Suppress Dust from Unpaved Roads at the INEEL Subsurface Disposal Area*, INEEL/EXT-01-01173, Rev 0., Idaho National Engineering and Environmental Laboratory, June 2003.

ICP, 2004a, *Operable Unit 10-08 Prioritization of Drilling Locations for Fiscal Year 2005 and Outyears (Draft)*, ICP/EXT-04-00705, Rev. 0, Idaho Completion Project, December 2004.

ICP, 2004b, *Central Facilities Area Landfills I, II, and III Annual Monitoring Report (2003)*, ICP/EXT-04-00149, Rev. 0, Idaho Completion Project, October 2004.

ICP, 2004c, *Annual Groundwater Monitoring Status Report for Waste Area Group 5 for Fiscal Year 2004*, ICP/EXT-04-00369, Rev. 1, Idaho Completion Project, November 2004.

Idaho Code § 39-4401 et seq., 1983, "Hazardous Waste Management Act of 1983," State of Idaho, Boise, Idaho.

INEEL, 2004, *Health and Safety Plan for the Long-Term Stewardship Sitewide Groundwater Monitoring*, INEEL/EXT-01-01644, Rev. 4, Idaho National Engineering and Environmental Laboratory, October 2004.

Knobel, L. L., B. R. Orr, and L. D. Cecil, 1992, "Summary of Concentrations of Selected Radiochemical and Chemical Constituents in Groundwater from the Snake River Plain Aquifer, Idaho: Estimated from an Analysis of Previously Published Data," *Journal of Idaho Academy of Science*, Vol. 28, No. 1, pp. 48–61, June 1992.

Mann, Larry J., and T. M. Beasley, 1994, *I-129 in the Snake River Plain Aquifer at and near the Idaho National Engineering Laboratory, Idaho, 1990-91*, U.S. Geological Survey Water Resources Report 94-4053.

NIOSH/OSHA/USCG/EPA, 1985, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, National Institution of Occupational Safety and Health, Occupational Safety and Health Administration, United States Coast Guard, and the U.S. Environmental Protection Agency, October 1985.

Rattray, G. W., and L. J. Campbell, 2003, *Radiochemical and Chemical Constituents in Water from the Southern Boundary of the Idaho National Engineering and Environmental Laboratory to the Hagerman Area, Idaho 2002*, U.S. Geological Survey Open File Report 2004-1004.

Twining, B. V., and G. W. Rattray, 2003, *Radiochemical and Chemical Constituents in Water from Selected Wells and Springs the Southern Boundary of the Idaho National Engineering and Environmental Laboratory to the Hagerman Area, Idaho 2001*, U.S. Geological Survey Open File Report 03-168.

USGS, 1999, *Chemical Constituents in Ground Water from 39 Selected Sites with an Evaluation of Associated Quality Assurance Data, Idaho National Engineering and Environmental Laboratory and Vicinity, Idaho*, U.S. Geological Survey Open File Report 99-246, 1999.

Appendix A

Water Level Measurement Locations and Well Construction Tables

Appendix A

Water Level Measurement Locations and Well Construction Tables

This appendix presents the wells to be used for groundwater level measurements each June. The water levels will be measured during a two-week period. However, water levels in a few wells might be measured outside this period if weather conditions, well access problems, or other factors prevent water levels from being measured. The wells to be measured in June are listed in Table A-1, and the locations of the wells are shown on the map provided. Wells that are screened or open in the upper 50 ft of the aquifer and will be given priority for the water level map are listed in Table A-2. Wells that will be used for vertical gradient analysis are listed in Table A-3. In addition to the wells listed in Table A-1, off-site wells Foster-1 (has ~500-ft water level, 4N 35E 20 CAA1), Foster-2 (has ~600 ft water level, 4N 35E 31 DAA-1), and Site-01 (E189608.65, N663612.96) may be measured, if accessible. The Foster wells are located east of the Appendix A map boundary between U.S. 20 and Highway 33, and the Site-01 well is located west of the INEEL site boundary. Water levels at additional off-site wells may be monitored if data are needed to support the groundwater model.

Table A-1. List of wells for water level measurements in June.

Official Well Name	Alias Well Name	Well ID Number	First Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Second Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Third Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type
Aquifer Wells														
ANL-MON-A-013	M-13	1075	637	665	6	SS screen								
ANP-04	ANP-04	72	219	319	12	Perforated								
ANP-10	ANP-10	78	552.44	675.98	10	Perforated								
ANP-5	ANP-05	73	296.24	316.44	10.25	Perforated	332.14	389.94	10.25	Perforated				
ANP-6	ANP-06	74	210.6	255.6	10.25	Perforated	265.66	295.82	10.25	Perforated				
ANP-7	ANP-07	75	353.79	431.21	8	Perforated								
ANP-8	ANP-08	76	232.8	304.65	8	Perforated								
ANP-9	ANP-09	77	236.64	313.84	8	Perforated								
ARA-MON A-002	ARA-MON-A-002	1004	600	620	5	SS slotted								
ARA-MON A-03A	ARA-MON-A-03A	1006	624	644	5	SS slotted								
ARA-MON-A-001	ARA-MON-A-001	1003	620	640	5	SS slotted								
ARA-MON-A-004	ARA-MON-A-004	1007	625	645	5	SS slotted								
Arbor Test	ARBOR TEST	82	679.94	730.49	10	Perforated	737.49	787	10	Perforated				
CFA-MON-A-001	CFA-MON-A-001	1077	488	518	5	304 wire								
CFA-MON-A-002	CFA-MON-A-002	1078	488	518	5	304 wire								
CFA-MON-A-003	CFA-MON-A-003	1089	490.9	510.9	5	Wire wrap								
DH1B	DH-1B	147	380	400	6	Open hole								
FET 3	FET Disposal	156	174.6	294.5	10	Perforated								
GIN-1	GIN-01	159	48	373	8	Open hole								
GIN-2	GIN-02	160	43	402	6	Open hole								
GIN-3	GIN-03	161	40	130	6.63	Perforated	176	386	6	Open hole				
GIN-4	GIN-04	162	41	306	6	Open hole								
GIN-5	GIN-05	163	30	430	4	Open hole								
Highway #2	Highway 2	183	741	786	8	Perforated								
ICPP-1782		1782	475	515	6	Wire-wrapped SS								
ICPP-1783		1783	475	515	6	Wire-wrapped SS								
ICPP-1800		1800	475	515	6	Wire-wrapped SS								
ICPP-1829		1829	475	515	6	Wire-wrapped SS								
ICPP-1831		1831	475	515	6	Wire-wrapped SS								
ICPP-MON-A-019	MW-18	1187	458.5	478.5	4	Sch.40 PVC								
ICPP-MON-A-164B	ICPP-164B	1349	493	533	4	SS								
ICPP-MON-A-164C	ICPP-164C	1350	487	527	6	SS								
ICPP-MON-A-166	ICPP-166	1352	487	527	6	SS								

Table A-1. (continued).

Official Well Name	Alias Well Name	Well ID Number	First Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Second Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Third Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type
ICPP-MON-A-167	ICPP-167	1383	462	502	6	SS								
ICPP-MON-A-230		1442	443	483	6	SS								
LF 2-08	LF2-08	196	485	495	6	Slotted screen								
LF 2-09	LF2-09	197	469.6	497	4	Slotted screen								
LF 2-10	LF2-10	198	725	735	6	Perforated	745	755	6	Perforated	755	765	6	Wire wrap
LF 2-11	LF2-11	199	~466	499	4	Slotted screen								
LF2-12	LF2-12	724	470	492		Wire-wrapped SS								
LF 3-08	LF3-08	207	500	510	6	Slotted screen								
LF 3-09	LF3-09	726	480	500	4.5	Wire wrap								
LF 3-10	LF3-10	727	481	501	4	Wire wrap								
M1S	M1SA	765	608	638	6	Wire wrap								
M3SA	M3S	766	602.8	632.8	6	Wire wrap								
M4D	M4D	767	798	828	6	Wire wrap								
M6S	M6S	768	638	668	6.0 ID	Wire wrap								
M7S	M7S	769	598	628	6	Wire wrap								
MTR-TEST	MTR TEST	231	447	588	8	Perforated								
NONAME-TAN-exp1	NO NAME 01	236	265	550	12	Open hole								
NPR-TEST	NPR TEST	239	504	532	6	Perforated								
NTP-Area 2	NTP-AREA 2	245	675.93	721.89	10	Perforated	741.89	813.83	10	Perforated	843.82	875.75	10	Perforated
OWSLEY-2	OWSLEY WELL 2	247	252	304	4.25	Open								
P&W-1	P&W-1	248	321.9	371.9	10	Perforated								
P&W-2	P&W-2	249	312.63	382.74	10	Perforated								
P&W-3	P&W-3	250	322.34	401.26	10	Perforated								
PBF-MON-A-001	PBF-MON-A-001	1085	454	484	5	304								
PBF-MON-A-003	PBF-MON-A-003	1087	545	575	5	304								
PBF-MON-A-004	PBF-MON-A-004	1094	522	542	5	Sch. 40 SS								
PBF-MON-A-005	PBF-MON-A-005	1095	511	531		Wire-wrapped SS								
PSTF Test	PSTF	256	189.78	315.85	10	Perforated								
RWMC-MON-A-013	A11A31	906	635	675	4	NF								
SITE-09	SITE-09	275	1000	1140	10	Open hole								
SITE-14	SITE-14	276	535	716.67	8	Open hole								
SITE-17	SITE-17	278	6	600	15	Open hole								
SITE-19	SITE-19	279	472.42	512.36	10	Perforated	532.57	572.45	10	Perforated	596.73	616.69	8	Perforated
SOUTH-MON-A-001	M11S	1212	559	569	6	NF	604	624	6	NF				
SOUTH-MON-A-002	M12S	1213	528	538	6	NF	548	568	6	NF				

Table A-1. (continued).

Official Well Name	Alias Well Name	Well ID Number	First Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Second Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Third Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type
SOUTH-MON-A-003	M13S	1214	593.1	603.1	6	NF	623.1	643.1	6	NF				
SOUTH-MON-A-004	M14S	1215	583.6	604.6	6	NF	624.6	634.6	6	NF				
SOUTH-MON-A-009	M15S	1338	600	620		Open?								
SOUTH-MON-A-010	M16S	1337	578	613	6	SS slot??								
STF-MON-A 003	STF-MON-A-003	1305	493.1	533.5	6	Wire wrap								
STF-MON-A 02A	STF-MON-A-02A	999	510	530	5	NA								
STF-MON-A-004	STF-MON-A-004	1306	500	540	6	Wire wrap								
STF-MON-A-01A	STF-MON-A-01A	998	538	558	5	304								
TAN 1859	TAN 1859	1859	210	270	1.25	?	195	302	9.875	Open hole				
TAN 1860	TAN 1860	1860	195.5	413	9.875	Open hole								
TAN 1861	TAN 1861	1861	217	277	6.625	Slotted	195.5	414	9.875	Open hole				
TAN CH2 MON 1	TCH-2	729	487.3	497.3	0.75	Slotted								
TAN CH2 MON2	TCH-2	729	1080	1090	0.75	Slotted								
TAN Drainage Disposal 2	TAN DD2	339	116	125.6	10.75	Perforated	201.4	221.5	10.75	Perforated	231.5	251.2	10.75	Perforated
TAN-04	TAN-04	343	213.5	245	4	Sl screen								
TAN-05	TAN-05	344	281.5	303	4	Sl screen								
TAN-06	TAN-06	746	235	255	4	Screen								
TAN-07	TAN-07	747	297.7	317.7	4	Wire wrap								
TAN-08	TAN-08	345	228.6	250	4	Sl screen								
TAN-09	TAN-09	346	300	322	4	Slotted steel								
TAN-10	TAN-10	347	213.6	245.25	4	Damaged screen								
TAN-10A	TAN-10A	348	216.4	249.5	4	Sl screen								
TAN-11	TAN-11	349	290	310	4	Sl screen								
TAN-12	TAN-12	748	362.8	382	4	Wire wrap								
TAN-13A	TAN-13A	749	216	236	4	Wire wrap								
TAN-14	TAN-14	750	376	396	4	Wire wrap								
TAN-15	TAN-15	751	232	252	4	Wire wrap								
TAN-16	TAN-16	752	302	322	4	Wire wrap								
TAN-17	TAN-17	728	320	340	2	Wire wrap								
TAN-18	TAN-18	790	496	516	4	304 (wire wrap)								
TAN-19	TAN-19	791	396	416	4	304 (wire wrap)								
TAN-20	TAN-20	792	352	372	4	304 (wire wrap)								
TAN-21	TAN-21	793	431	451	4	304 (wire wrap)								
TAN-22A	TAN-22A	795	511	531	4	304 (wire wrap)								
TAN-23A	TAN-23A	797	435	455	4	304 (wire wrap)								

Table A-1. (continued).

Official Well Name	Alias Well Name	Well ID Number	First Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Second Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Third Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type
TAN-24A	TAN-24A	799	218	238	4	304 (wire wrap)								
TANT-MON-A-048	TAN-48	1211	190	230	6	Louvered								
TANT-MON-A-050	TAN-50	1315	205	445	9 7/8	Open hole								
TANT-MON-A-051	TAN-51	1316	205	445	9 7/8	Open hole								
TANT-MON-A-052	TAN-52	1317	200	470	9 7/8	Open hole								
TANT-MON-A-054	TAN-54	1340	199.5	474	9.875	Open hole								
TANT-MON-A-055	TAN-55	1341	200	400	9.875	Open hole								
TANT-MON-A-057	TAN-57	1343	200	491	9.875	Open hole								
TAN-9	TAN-09	346	300.4	322.4	4	Sl screen								
TANT-INJ-A-003	TAN-31	1219	204.6	310	9.875	Open hole								
TANT-MON-A-004	TANT-MON-A-001	1100	217	250	5	Slotted SS								
TANT-MON-A-006	TAN-32	1134	195	255	4	NF	280	315	4	NF	370	399.9	4	NF
TANT-MON-A-007	TAN-33	1135	234	441	7 7/8	Open hole								
TANT-MON-A-008	TAN-34	1136	195	420	7 7/8	Open hole								
TANT-MON-A-009	TAN-35	1137	195	420	7 7/8	Open hole								
TANT-MON-A-010	TAN-36	1138	200	443	9 7/8	Open hole								
TANT-MON-A-011	TAN-37	1163	205	416	9 7/8	Open hole								
TANT-MON-A-015	TAN-41	1167	195	422	5.75	Open hole								
TANT-MON-A-016	TAN-42	1168	235	440	5.75	Open hole								
TANT-MON-A-017	TAN-43	1169	220	438	5.75	Open hole								
TANT-MON-A-018	TAN-44	1170	221	442	5.75	Open hole								
TANT-MON-A-019	TAN-45	1171	225	440	5.75	Open hole								
TANT-MON-A-020	TAN-46	1172	220	442	5.75	Open hole								
TANT-MON-A-025	TAN-26	1118	368.5	408.5	5	V-wire								
TANT-MON-A-027	TAN-27	1009	220.37	250.37	5	Screen								
TANT-MON-A-028	TAN-28	1008	220	260	5	Screen								
TANT-MON-A-029	TAN-29	1010	222.25	262.25	5	Screen								
TANT-MON-A-030A	TAN-30A	1012	299.9	319.9	5	Screen								
TANT-MON-A-047	TAN-47	1314	205	445	9 7/8	Open hole								
TANT-MON-A-050	TAN-50	1315	205	445	9 7/8	Open hole								
TANT-MON-A-056	TAN-56	1342	200	460	9.875	Open hole								
TANT-MON-A-058	TAN-58	1344	200	483	9.875	Open hole								
TANW-MON-A-MW-2	MW-2	1013	200	240	5	Screen								
TCH-1	TAN-CH MON2	337	389	394	1.25	Sl screen								
TRA 06A	TRA-06	808	528	558	4	Wire wrap								

Table A-1. (continued).

Official Well Name	Alias Well Name	Well ID Number	First Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Second Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Third Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type
TRA 07	TRA-07	731	463	493	4	Wire wrap								
TRA 08	TRA-08	732	471.5	501.5	4	Wire wrap								
TSF 05 (71)	ANP-03	71	180	244	12	Perforated	269	305	12	Perforated				
USGS-001	USGS-001	450	600	630	5	Perforated								
USGS-002	USGS-002	451	675	696	5	Perforated								
USGS-004	USGS-004	453	285	315	6.25	Perforated	322	553	4	Open hole				
USGS-005	USGS-005	454	475	497		Perforated CS								
USGS-006	USGS-006	455	452	475	4.9	Perforated	532	620	4	Open hole				
USGS-007	USGS-007	456	241	261	6	Sl screen	760	940	5.5	Open hole	940	1200	3.5	Open hole
USGS-008	USGS-008	457	781.84	811.96	6.25	Perforated								
USGS-009	USGS-009	458	620.14	650.14	6	Perforated								
USGS-011	USGS-011	460	672.52	703.84	6.25	Perforated								
USGS-012	USGS-012	461	587	692	10	Open hole								
USGS-013	USGS-013	462	997.88	1200	5.75	Open hole								
USGS-014	USGS-014	463	720	746	5	Perforated								
USGS-015	USGS-015	464	540	610	10	Open hole								
USGS-017	USGS-017	466	437.79	444.79	5	Perforated	495.79	498	4	Open hole				
USGS-018	USGS-018	467	299	324	4.25	Perforated								
USGS-019	USGS-019	468	284.86	305.86	6	Perforated								
USGS-020	USGS-020	469	467	477	6.25	Perforated	515	552	6.25	Perforated				
USGS-021	USGS-021	470	360	400	5	Perforated	404.5	405.5	~6.25	Open hole				
USGS-022	USGS-022	471	619	633	6	Perforated	645	655	6	Perforated				
USGS-023	USGS-023	472	410	430	6.25	Perforated								
USGS-024	USGS-024	473	255	265	8.25	Perforated	270	275	8.25	Perforated	285	325	8.25	Perforated
USGS-025	USGS-025	474	285	320	6.25	Perforated								
USGS-026	USGS-026	475	232	266.5	6.25	Perforated								
USGS-027	USGS-027	476	250	260	6.25	Perforated	298	308	6.25	Perforated				
USGS-029	USGS-029	478	363	398	5.62	Perforated	398	425.5	4	Open hole				
USGS-030 A	USGS-030 A	479	290	300	2	Perforated								
USGS-030 B	USGS-030 B	479	393	398	0.75	Perforated								
USGS-030 C	USGS-030 C	479	718	750	1	Perforated, open								
USGS-031	USGS-031	480	270	304	8	Perforated	306	428	8	Open hole				
USGS-032	USGS-032	481	306	324	6.25	Perforated	324	392	5.5	Open hole				
USGS-034	USGS-034	483	500	578	10	Open hole								
USGS-035	USGS-035	484	142.5	578.5	7	Open hole								

Table A-1. (continued).

Official Well Name	Alias Well Name	Well ID Number	First Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Second Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Third Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type
USGS-036	USGS-036	485	430	567.1	6	Open hole								
USGS-037	USGS-037	486	507	571.5	6	Open hole								
USGS-038	USGS-038	487	678	729	4	Open hole								
USGS-039	USGS-039	488	46.6	152	10	Open hole	48	493	8	Open hole	507	572	6	Open hole
USGS-040	USGS-040	489	452	678.8	4	Perforated								
USGS-041	USGS-041	490	428.09	674.4	6	Open hole								
USGS-042	USGS-042	491	452.52	678.45	6	Open hole								
USGS-043	USGS-043	492	450.54	675.8	6	Open hole								
USGS-044	USGS-044	493	461	650	6	Open hole								
USGS-045	USGS-045	494	461	651.21	6	Open hole								
USGS-046	USGS-046	495	461.33	650.86	6	Open hole								
USGS-047	USGS-047	496	458	651		Open hole								
USGS-048	USGS-048	497	462.1	750	6	Open hole								
USGS-049	USGS-049	498	458.29	656	6	Open hole								
USGS-051	USGS-051	500	475.2	659	6	Open hole								
USGS-052	USGS-052	501	450	650	6	Open hole								
USGS-057	USGS-057	506	474	732	6	Open hole								
USGS-058	USGS-058	507	218	473	6	Open hole	473	503	5.5	Open hole				
USGS-059	USGS-059	508	464	657	6	Open hole								
USGS-065	USGS-065	514	~456	472	6	Open hole	472	498	4	Open hole				
USGS-067	USGS-067	516	315	465	6.63	Perforated	465	552	6	Open hole	635	694	4	Open hole
USGS-076	USGS-076	525	457	718	6	Open hole								
USGS-077	USGS-077	526	470	586	6	Open hole								
USGS-079	USGS-079	528	281	702	6	Open hole								
USGS-082	USGS-082	531	470	570	6.625	Perforated	593	693	6	Open hole				
USGS-083	USGS-083	532	516	752	6	Open hole								
USGS-084	USGS-084	533	420	505		Perforated CS								
USGS-086	USGS-086	535	48	691	8	Open hole								
USGS-087	USGS-087	536	585	673	4	Perforated								
USGS-088	USGS-088	537	584	635	4	Perforated								
USGS-089	USGS-089	538	576	646	6	Open hole								
USGS-090	USGS-090	539	577	626		Perforated CS								
USGS-097	USGS-097	546	388	510	4	Open hole								
USGS-098	USGS-098	547	401	421	4	Perforated	463	505	4	Perforated				
USGS-099	USGS-099	548	~340	449	4	Perforated	449	450	6	Open hole				

Table A-1. (continued).

Official Well Name	Alias Well Name	Well ID Number	First Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Second Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Third Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type
USGS-100	USGS-100	549	662	750	6	Open hole								
USGS-101	USGS-101	550	750	865	4	Perforated								
USGS-103	USGS-103	552	575	760	8	Open hole								
USGS-104	USGS-104	553	550	700	8	Open hole								
USGS-105	USGS-105	554	400	800	8	Open hole								
USGS-106	USGS-106	555	400	605	10	Open hole	605	760	8	Open hole				
USGS-107	USGS-107	556	270	690	8	Open hole								
USGS-108	USGS-108	557	400	760	8	Open hole								
USGS-109	USGS-109	558	600	800	4	Perforated								
USGS-110	USGS-110	559	580	780	6	Perforated								
USGS-112	USGS-112	561	430	444	10	Open hole	444	563	8	Open hole				
USGS-113	USGS-113	562	443	561	6	Open hole								
USGS-114	USGS-114	563	440	560	6	Open hole								
USGS-115	USGS-115	564	437	580	6	Open hole								
USGS-116	USGS-116	565	401	438	8	Open hole	438	572	6	Open hole				
USGS-117	USGS-117	566	550	653	6.63	Perforated								
USGS-118	USGS-118	567	587.2	608	2	Saw slotted								
USGS-119	USGS-119	568	639	705	6.63	Perforated								
USGS-120	USGS-120	569	638.1	705	6.63	Perforated								
USGS-121	USGS-121	570	449	475		Slotted SS								
USGS-122	USGS-122	571	448.7	474.9	3	Slotted screen								
USGS-123	USGS-123	572	449.5	475.3	6	Slotted screen								
USGS-128	USGS-128	1413	457	615		Open								
USGS-OBA-A-127	USGS-127	1347	496	596	6	Screen								
USGS-OBS-A-124	USGS-124	987	750	800	4	Slotted screen								
USGS-OBS-A-125	USGS-125	988	620	774	5.5	Slotted screen								
USGS-OBS-A-126A	USGS-126A	1345	624	648	6	Open hole								
USGS-OBS-A-126B	USGS-126B	1346	407	452	20	Open hole								
WATER SUPPLY FOR INEL 1	WSI-1	595	340	497	6	Perforated	507	594.5	8	Open hole				
FIRE STATION WELL	firestn	158	429.4	518.1	10	Open hole								
ICPP-MON-A-165	ICPP-165	1351	485	525	6	Slotted screen								
ICPP-MON-A-022	ICPP-022	1092	490	510	5	Slotted screen								
RWMC-MON-A-066	OW2	1132	600	1000	7 7/8	Open hole								
USGS-028		477	254	274		Slotted screen								
RWMC-MON-A-162	M17S	1327	598.5	628.5	6	Slotted screen								

Table A-1. (continued).

Official Well Name	Alias Well Name	Well ID Number	First Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Second Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type	Third Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type
NRF-MON-A-010	NRF-10	1081	377	427	6									
NRF-MON-A-012	NRF-12	1083	371	421	6									
NRF-MON-A-013	NRF-13	1084	375	425	6									
SOUTH-1835		1835	598	638	6	Wire wrap								
CERRO GRANDE		92	551	567	3	Open hole								
DH2A		148	415	430	6	Open hole								
SITE-06		274	366	464.25	10	Perforated								
SITE-16		277	655.43	733.26	8	Perforated								
USGS-102		551	360	444.6	5.88	Open hole								
Middle-1823		1823	680	720	6	Slotted screen								
USGS-128		1413	457	615	~4 to 5	Open hole								
USGS-130		1836	468	638	4.5	Slotted	638	639	4.5	End cap				
USGS-131		1837	537	797	5.875	Open hole								
Perched Wells														
PW-12	PW-12	760	108	128		Wire-wrapped SS								
PW-14	PW-14	734	93	123		Wire-wrapped SS								
USGS-053	USGS-053	502	50	67	4.63	Perforated	75	80	4.63	Perforated				
USGS-054	USGS-054	503	60	91	6	Open hole								
USGS-055	USGS-055	504	43.92	81	6	Open hole								
USGS-056	USGS-056	505	59	80		Open hole								
USGS-060	USGS-060	509	59	117	6	Open hole								
USGS-061	USGS-061	510	89	123	4	Perforated								
USGS-062	USGS-062	511	145	165	8	Open hole								
USGS-063	USGS-063	512	62	110	10	Open hole								
USGS-066	USGS-066	515	160	200	6.63	Perforated								
USGS-070	USGS-070	519	54	100		Open hole								
USGS-072	USGS-072	521	135	160		Perforated CS								
USGS-073	USGS-073	522	62	127	6	Open hole								
PW-11	PW-11	759	109	129	4	Wire wrap								

bls = below land surface
CS - carbon steel
NA = not applicable
NF = not found
Sl = slotted
SS = stainless steel

Table A-2. List of wells screened or open at the water table to be given priority for generating a water level contour map.

Location	Well ID	Depth to Water (ft below measuring point)	Stickup (ft)	Depth to Water (ft bls)	Corrected Depth to Water (ft bls)[a]	Distance between Lowest Screen Interval and Water Table	Water Table Elevation	Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type
ANL-MON-A-013	1075	648.86	3.15	645.71	645.90	19	4474.46	637	665	6	SS screen
ARA-MON A-002	1004	601.31	3.01	598.3	598.3	22	4439.20	600	620	5	SS slotted
ARA-MON A-03A	1006	612.18	3.21	608.97	608.97	35	4441.25	624	644	5	SS slotted
ARA-MON-A-001	1003	598.12	3.03	595.09	595.09	45	4439.68	620	640	5	SS slotted
ARA-MON-A-004	1007	626.47	3.08	623.39	623.39	22	4441.29	625	645	5	SS slotted
CFA-MON-A-001	1077	496.14	2.7	493.44	493.44	25	4443.04	488	518	5	304 Wire
CFA-MON-A-002	1078	492.48	2.59	489.89	489.89	28	4442.40	488	518	5	304 Wire
CFA-MON-A-003	1089	491.84	2.32	489.52	489.52	21	4440.82	490.9	510.9	5	Wire wrap
ICPP-1782	1782	477.18	2.55	474.63	474.68	40	4448.11	475	515	6	Wire-wrapped SS
ICPP-1783	1783	475.52	2.37	473.15	473.20	42	4448.31	475	515	6	Wire-wrapped SS
ICPP-1800	1800	474.77	2.38	472.39	472.44	43	4448.22	475	515	6	Wire-wrapped SS
ICPP-1829	1829	474.16	2.57	471.59	471.64	43	4448.25	475	515	6	Wire-wrapped SS
ICPP-1831	1831	477.70	2.63	475.07	475.12	40	4448.56	475	515	6	Wire-wrapped SS
ICPP-MON-A-164B	1349	503.35	3.04	500.31	500.36	33	4448.30	493	533	4	SS
ICPP-MON-A-164C	1350	506.67	3.21	503.46	503.51	24	4448.40	487	527	6	SS
ICPP-MON-A-166	1352	510.74	2.84	507.9	507.95	19	4448.05	487	527	6	SS
ICPP-MON-A-167	1383	501.41	3.12	498.29	498.34	4	4448.42	462	502	6	SS
ICPP-MON-A-230b		-	-	-	-	-	-	443	483	6	SS
LF 2-08	196	489.02	2.58	486.44	486.44	12	4448.27	485	495	6	Sl screen
LF 2-09	197	492.27	2.73	489.54	489.54	13	4448.16	469.6	497	4	Sl screen
LF 2-11	199	483.33	3.32	480.01	480.01	19	4448.44	~466	499	4	Sl screen
LF 3-08	207	499.45	2.53	496.92	496.92	18	4448.48	500	510	6	Sl screen
LF 3-09	726	495.91	3.08	492.83	492.83	7	4448.36	480	500	4.5	Wire wrap
LF 3-10	727	497.28	2.78	494.5	494.5	7	4448.18	481	501	4	Wire wrap
M1S	765	592.99	3.69	589.30	589.36	49	4421.92	608	638	6	Wire wrap
M3SA	766	596.61	2.61	594.00	594.06	39	4422.29	602.8	632.8	6	Wire wrap
M6S	768	647.53	3.56	643.97	644.03	24	4421.75	638	668	6	Wire wrap
M7S	769	585.76	3.83	581.93	581.99	46	4423.05	598	628	6	Wire wrap
P&W-1	248	325.61	1.55	324.06	324.16	48	4571.45	321.9	371.9	10	Perforated
PBF-MON-A-001	1085	451.68	2.37	449.31	449.31	35	4456.86	454	484	5	304 wire
PBF-MON-A-004	1094	502.03	3.33	498.7	498.7	43	4441.02	522	542	5	Sch. 40 SS

Table A-2. (continued).

Location	Well ID	Depth to Water (ft below measuring point)	Stickup (ft)	Depth to Water (ft bls)	Corrected Depth to Water (ft bls)[a]	Distance between Lowest Screen Interval and Water Table	Water Table Elevation	Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type
SOUTH-MON-A-009 (M15S)	1338	599.92	2.86	597.06	597.12	23	4422.08	600	620		Open?
SOUTH-MON-A-010 (M16S)	1339	583.31	2.47	580.84	580.90	35	4425.90	578	613	6	SS slot?
STF-MON-A 003	1305	506.69	2.73	503.96	503.96	30	4433.19	493.1	533.5	6	Wire wrap
STF-MON-A 02A	999	504.03	3.3	500.73	500.73	29	4436.59	510	530	5	Not applicable
STF-MON-A-004	1306	514.22	2.83	511.39	511.39	29	4434.08	500	540	6	Wire wrap
TAN-04	343	232.39	2.32	230.07	230.14	15	4571.18	213.5	245	4	Sl screen
TAN-04	343	232.38	2.32	230.06	230.13	15	4571.19	213.5	245	4	Sl screen
TAN-06	746	217.84	1.92	215.92	215.98	39	4570.89	235	255	4	Screen
TAN-08	345	221.11	0.97	220.14	220.21	30	4570.18	228.6	250	4	Sl screen
TAN-10	347	211.38	2.49	208.89	208.95	36	4571.37	213.6	245.25	4	Damaged screen
TAN-10A	348	211.31	1.89	209.42	209.48	40	4571.22	216.4	249.5	4	Sl screen
TAN-13A	749	212.20	1.93	210.27	210.33	26	4570.24	216	236	4	Wire wrap
TAN-15	751	218.30	1.60	216.7	216.77	35	4570.15	232	252	4	Wire wrap
TAN-24A	799	220.20	2.50	217.7	217.77	20	4570.88	218	238	4	304 (wire wrap)
TAN-48	1211	218.48	1.61	216.87	216.94	13	4572.75	190	230	6	Louvered
TANT-MON-A-004	1100	210.65	2.83	207.82	207.88	43	4574.23	217.4	250.4	5	Slotted SS
TANT-MON-A-027	1009	211.09	1.97	209.12	209.18	41	4571.25	220.37	250.37	5	Screen
TANT-MON-A-028	1008	212.89	2.58	210.31	210.37	50	4571.04	220	260	5	Screen
TANW-MON-A-MW-2	1013	220.44	2.12	218.32	218.39	22	4570.94	200	240	5	Screen
TRA-07	731	485.50	3.76	481.74	481.79	12	4450.26	463	493	4	Wire wrap
TRA-08	732	489.38	2.5	486.88	486.93	15	4448.63	471.5	501.5	4	Wire wrap
USGS-001	450	595.47	1.41	594.06	594.00	36	4428.85	600	630	5	Perforated
USGS-002	451	668.99	1.31	667.68	667.75	28	4458.24	675	696	5	Perforated
USGS-008	457	774.81	1.5	773.31	773.39	39	4422.05	781.84	811.96	6.25	Perforated
USGS-009	458	615.53	1.06	614.47	614.41	36	4417.51	620.14	650.14	6	Perforated
USGS-011	460	660.18	2.24	657.94	657.87	46	4409.02	672.52	703.84	6.25	Perforated
USGS-014	463	722.32	0.54	721.67	721.60	24	4411.48	720	746	5	Perforated
USGS-018	467	283.33	2.65	280.68	-	43	4524.14	299	324	4.25	Perforated
USGS-019	468	285.48	2.91	282.57	282.57	23	4518.05	284.86	305.86	6	Perforated
USGS-023	472	414.27	3.73	410.54	410.54	19	4474.13	410	430	6.25	Perforated
USGS-025	474	279.50	1.38	278.12	278.20	42	4571.24	285	320	6.25	Perforated
USGS-026	475	219.50	2.61	216.89	216.96	50	4572.57	232	266.5	6.25	Perforated

Table A-2. (continued).

Location	Well ID	Depth to Water (ft below measuring point)	Stickup (ft)	Depth to Water (ft bls)	Corrected Depth to Water (ft bls)[a]	Distance between Lowest Screen Interval and Water Table	Water Table Elevation	Screen Top (ft bls)	Screen Bottom (ft bls)	Screen Diameter (in.)	Screen Type
USGS-030A	479	269.70	1.14	268.56	268.64	31	4526.20	290	300	2	Perforated
USGS-086	535	657.44	1.94	655.5	655.43	36	4421.71	48	691	8	Open hole
USGS-088	537	600.91	3.08	597.83	597.89	37	4423.73	584	635	4	Perforated
USGS-089	538	610.00	2.89	607.11	607.17	39	4422.75	576	646	6	Open hole
USGS-118	567	592.76	3.31	589.45	589.51	19	4423.06	587.2	608	2	Saw slotted
USGS-121b	570	-	-	-	-	-	-	449	475		Slotted SS
USGS-122	571	467.04	1.92	465.12	465.17	10	4449.09	448.7	474.9	3	Sl screen
USGS-123	572	473.24	3.06	470.18	470.23	5	4449.04	449.5	475.3	6	Sl screen
USGS-OBS-A-126B	1346	420.31	2.50	417.81	417.94	34	4571.31	407	452	20	Open hole

a. E-line calibration correction.
b. Water level was not measured June 2004.

bls = below land surface
Sl = slotted
SS = stainless steel

Table A-3. Wells to be used for vertical gradient evaluation.

WELL PAIR	Well ID	Land Surface or or Brass Cap Elevation	Well Pair Designation[a]	Screen Top Depth (ft bls)	Screen Bottom Depth (ft bls)	Screen Diameter (in.)	Screen Type	Horizontal Distance between Wells (ft)	Water Level Date	Corrected Depth to Water (Removed Stickup)	Borehole Deviation Correction	Water Table Elevation (ft)	Vertical Gradient (ft)[b]
ANP-9	77	4786.42	Shallow	236.64	314	8	Perforated	1378	6/8/2004	230.41	NF	4556.01	1.86
ANP-10	78	4786.20	Deep	552.44	676	10	Perforated		3/31/2004	228.18	NF	4557.87	
LF 2-08[c]	196	4931.72	Shallow	485	495	6	Slotted screen	100	6/8/2004	486.44	2.99	4448.27	-2.11
LF 2-09[c]	197	4932.23	Shallow	469.6	497	4	Slotted screen	101	6/8/2004	489.54	5.47	4448.16	-2.00
LF 2-10	198	4932.48	Deep	725	735	6	Perforated		6/8/2004	487.07	0.75	4446.16	
USGS-88	537	5021.26	Shallow	585	673	4	Perforated	115	6/8/2004	597.89	0.36	4423.73	-0.38
M4D	767	5022.53	Deep	798	828	6	Wire wrap		6/8/2004	599.66	0.48	4423.35	
STF-MON-A 02A	999	4937.30	Shallow	510	530	5	NA (probably slotted)	2349	6/8/2004	500.73	0.02	4436.59	9.27
SITE-09	275	4926.03	Deep	1000	1140	10	Open hole		6/8/2004	480.17	NF	4445.86	
USGS-118	567	5012.4	Shallow	587.2	608	2	Saw slotted	346	6/8/2004	589.51	0.17	4423.06	-1.23
USGS-119	568	5031.91	Deep	639	705	6.63	Perforated		6/8/2004	610.95	0.87	4421.83	
USGS-065	514	4925.01	Shallow	456	472	*6*	Open hole	97	6/8/2004	472.63	NF	4452.38	-4.95
TRA-06A	763	4925.60	Deep	528	558	4	Wire wrap		6/8/2004	478.36	0.19	4447.43	
NESTED PIEZOMETERS													
USGS-030 A	479	4794.84	Shallow	290.00	300	2.00	Perforated	0	6/9/2004	268.64		4526.20	-13.06
USGS-030 B	479	4794.84	Deep	392.50	397.5 (493)	0.75	Perforated (open hole)		6/9/2004	281.73		4513.10	0.03
USGS-030 C	479	4794.84	Deepest	717.5	722.5 (750)	1	Perforated (open hole)		6/9/2004	281.70		4513.13	

a. Groups of wells that might be useful in determining vertical gradients for the OU 10-08 groundwater model (criteria: vertically separated open intervals, relatively near each other, single intervals each, minimal screen overlap, contemporaneous water level data, located within the model domain, not penetrating the bottom of the model domain).
b. A postive value indicates an upward gradient, and a negative value indicates a downward gradient.
c. Either LF2-08 or LF2-09 could be used as a shallow well paired with LF2-10.

bls = below land surface
NF = not found